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ABSTRACT

The first of three parts of a computer awareness program for grades K-9, this guide includes objectives, implementation suggestions, and varied student activity worksheets for a five-unit, primary computer literacy program. A program overview includes the program rationale, goals, description and development, time allotment, and objectives for K-3 computer awareness. A discussion of program implementation covers hardware, gender equity, special needs, and student evaluation. Integration of computer awareness with subject areas is addressed and a K-3 Computer Awareness Integration Chart is included. The first unit introduces the use of the microcomputer in the classroom and describes procedures for microcomputer care, handling, moving, and scheduling. Unit 2 focuses on student interaction with exemplary educational courseware and on understanding the input/processing/output sequence and procedural thinking. Unit 3 examines the development of calculation aids, and the fourth unit prepares students for future work with computers. The final unit promotes awareness of computer technology in the home, school, and community, and emphasizes integration with the social studies and language arts curricula. (LMM)

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K-3 computer awareness

interim guide

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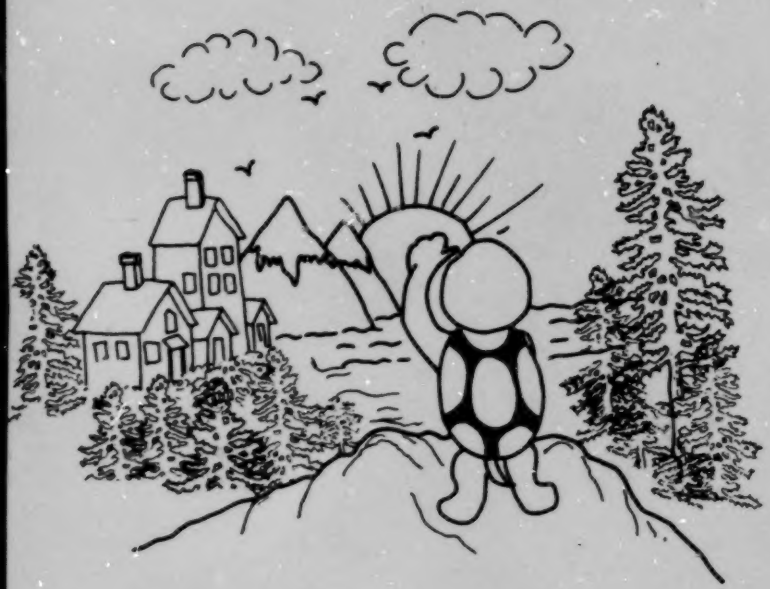

RATIONALE

This guide was developed to assist teachers in achieving the goals believed appropriate for the development of computer awareness in a young child. For purposes of this document the definition of "computer awareness" will be that proposed by the Manitoba Computer Awareness Task Force (K-12) in March, 1982. The Task Force considered that computer awareness includes:

- an understanding of what computers can and cannot do;
- interaction and communication with computers;
- using computers to solve problems; and
- using computers in the educational setting.

The underlying aim of computer awareness is to promote an understanding of the uses of computer technology in the home, in the school, and in the community as well as the knowledge of some of the effects of this technology.

The development of the Manitoba K-9 Computer Awareness curriculum was the result of both the philosophical support of the Computer Awareness Task Force (K-12) and the expressed need from within the educational community. This need was demonstrated by the development of school initiated computer awareness programs. In turn, these school initiated programs were the response of the educational community to the need expressed by students and parents to emphasize a more adequate preparation for a society which is a user of computer technology.

The K-3 Computer Awareness guide is one part of a three-part K-9 Computer Awareness program intended to provide the teacher with enough information to establish introductory computer awareness for all students in these grades. The K-9 program has been divided into three guides, namely, K-3, 4-6, and 7-9.

Consider K-3 Computer Awareness to be:

1. optional rather than mandatory,
2. a series of five units requiring 10-15 hours for each of the four years,
3. taught using either an integrated or a discrete approach although all pilot teachers emphasized the benefits of integration,
4. a scope and sequence of objectives divided according to grade level (level K, 1, 2, 3) and according to expected student mastery (introduction, expansion, proficiency), as well as
5. a sampling of activities suggested for use at the various levels.

Computer awareness should not be interpreted as the specialization of one subject area or of one group of educators. Rather, all classroom teachers should become involved in using computer technology so that it can achieve its appropriate place in serving education as a tool to aid student learning and instruction in the classroom.

The computer awareness program addresses the diverse backgrounds of both students and teachers as well as the various types and quantities of computer hardware and courseware. Many of the objectives outlined in this document can be achieved without the use of a computer. However, hands-on activities are highly recommended in order to provide concrete experiences and to increase motivation.

The phenomenon of increasing knowledge and sophistication of students with respect to educational computing in general and to computer awareness in particular is anticipated to result in the need for revision on a frequent and on-going basis.

Educators might still ask, "But why teach computer awareness? What part does computer awareness play in the primary curricula?" One valid and overwhelmingly compelling reason for including computer awareness is that it becomes the initial step in the students' control over and use of a powerful and emerging technology.

GOALS

Based on the computer awareness model for Manitoba as defined in the Report of the Computer Awareness Task Force (K-12) computer awareness for grades K-9 has been designed to promote familiarity with computers, ability to interact and to communicate with computers, and understanding of computer applications and implications within society.

In support of these aims, K-3 Computer Awareness has the following specific goals:

1. To become familiar with the computer as part of the learning environment.
2. To become comfortable interacting with a computer.
3. To demonstrate appropriate care and handling of computer systems.
4. To acquire a knowledge of the components of a computer system.
5. To appreciate the development of computing devices as they increase in complexity and capability.
6. To become aware of possible and probable future uses and development of computers.
7. To develop skills in creative problem-solving.
8. To achieve the ability to solve problems through the use of educational computing.
9. To appreciate the extensive use of computer technology in homes, schools, local communities, and society in general.
10. To become aware of the advantages and limitations of computer technology.

DESCRIPTION AND DEVELOPMENT

THE GUIDE

The Program Outline section of the K-3 Computer Awareness guide describes a set of basic concepts, skills and attitudes related to computer technology and arranges these in a three-column format:

1. The objectives, outlined on the left-hand side of these pages, identify those concepts, skills, and attitudes central to the achievement of computer awareness in the primary grades. Each objective is followed by the desired expectation of student knowledge or mastery. "Introduction" implies first exposure, "Expansion" indicates an extension to new areas built on knowledge gained during a previous exposure in that same or a preceding school year, and "Proficiency" denotes an appropriate student competence.

2. Additional information for the teacher has been included in the middle of these pages under the heading "Notes and Explanations." Details relating to background knowledge, to intended scope, and to classroom activities have been included under this heading. Activities are either in the form of suggestions which the classroom teacher may develop according to student needs (these suggestions are inset and starred *) or in the form of fully developed activities found in the activities section of the guide. Fully developed activities are provided courtesy of committee members and pilot teachers.

3. All developed activities are coded in the third column as follows:

    II-4-6
    LA/Sc

    II-4-6 indicates that the activity is part of Unit II, accompanies Objective 4 and is the 6th developed activity for that objective. Integration information is found beneath this coding. In the example, LA/Sc indicates that activity II-4-6 could be integrated with either Language Arts or Science. The teacher could then refer to the K-3 Computer Awareness Integration Chart found in the Integration section of this guide to determine the specific concepts/skills in the Language Arts or Science curricula with which that particular activity integrates.

    Experience gained during the pilot program suggests that teachers used the guide in two distinct ways. Some chose to follow the sequence of units and objectives as presented. Others preferred to select and to combine objectives from a number of units in an attempt to meet the particular needs of their students. The second method provided greater opportunity for integration of computer awareness with other primary classroom activities. For this reason, it is necessary to emphasize that the K-3 Computer Awareness units need be taught neither in a block nor in the sequence presented in the guide.

UNIT DESCRIPTIONS

In order for young students to become comfortable as computer users it is necessary to provide ample opportunity for "hands-on" experience with a microcomputer wherever possible throughout the five units which comprise K-3 Computer Awareness.

Unit I: GETTING STARTED! 10%

This unit is intended to give the teacher and students hands-on experience as an introduction to the use of the microcomputer in the classroom. Procedures for the care, handling, moving, and scheduling of the microcomputer are discussed. Since teachers should begin computer awareness with hands-on microcomputing experiences, it is recommended that the class have access to at least one microcomputer in order to achieve the objectives of this unit.

Unit II: WHAT IS A COMPUTER? 20%

This topic is intended to increase student awareness of how a computer works through student interaction with exemplary educational courseware. Emphasis is placed on achieving understanding of the input/processing/output sequence and of procedural thinking. Access to a microcomputer is recommended.

Unit III: HOW COMPUTERS HAVE DEVELOPED 5%

This unit is intended to expose students to the development of calculation aids from finger calculators to computers. Discussion of this topic is more appropriate at the upper primary grade levels but actual experiences with the various devices are appropriate at all levels. It is recommended that the students be provided with hands-on experience with devices such as abacuses, mechanical calculators, electronic calculators, and electronic learning aids, as well as microcomputers.

Unit IV: HOW TO MAKE COMPUTERS WORK FOR YOU 45%

This unit is intended to prepare students, through the development of problem-solving skills and logical thinking techniques, for future work with computers. The creative thinking skills acquired through the use of computers help to reinforce those used in other areas of the primary curriculum. Emphasis is to be placed on partial solutions, on debugging, and on discovery-based learning. If possible, students should be provided with hands-on experiences using educational courseware to illustrate uses of the computer as a tool.

Unit V: COMPUTERS IN OUR LIVES 20%

This unit is intended to promote student awareness of computer technology in the home, school, and community. Emphasis is placed on integration with the Social Studies and Language Arts curricula. It is not necessary to have access to a microcomputer in the classroom in order to successfully achieve this awareness.

TIME ALLOTMENT

The K-9 Computer Awareness program has been designed as a series of three optional guides developed for the following grade levels and requiring the identified contact times.

Grade Levels	Contact Time
K-3	10-15 hours per year
4-6	15-20 hours per year
7-9	20-25 hours per year

The recommended contact time for K-3 Computer Awareness should be distributed over the units in the following way:

- Unit I: Getting Started! 10%
- Unit II: What Is A Computer? 20%
- Unit III: How Computers Have Developed 5%
- Unit IV: How To Make Computers Work For You 45%
- Unit V: Computers in Our Lives 20%

Pilot teachers from grades two/three felt that the computer awareness objectives are best presented throughout the school year. However, kindergarten and grade one teachers indicated that the program should begin later in the school year, preferably after the Christmas or Spring breaks.

OBJECTIVES FOR K-3 COMPUTER AWARENESS

	Level K	Level 1	Level 2	Level 3
I. GETTING STARTED! 10%				
1. to identify and to use appropriate keys on the microcomputer keyboard;	Introduction	Expansion	Expansion	Expansion
2. to identify the major parts of a microcomputer system and to demonstrate adequate care of those parts in the classroom;	Introduction	Expansion	Expansion	Proficiency
3. to show how to switch on a microcomputer under adult supervision;		Introduction	Expansion	Proficiency
4. to demonstrate the classroom rules for the use of the microcomputer;		Introduction	Expansion	Proficiency
5. to demonstrate the procedures to follow if trouble is encountered in the operation of the microcomputer system.	Introduction	Expansion	Expansion	Expansion
II. WHAT IS A COMPUTER? 20%				
1. to understand that a computer is a machine with which a person can interact;	Introduction	Expansion	Expansion	Expansion
2. to relate the major parts of the microcomputer to the Input-Processing-Output sequence;			Introduction	Expansion
3. to arrange a series of steps in a sequence to form a procedure;		Introduction	Expansion	Expansion

	Level K	Level 1	Level 2	Level 3
4. to recognize that a procedure which allows a computer to perform complex tasks is a sequence of instructions.				Introduction
III. HOW COMPUTERS HAVE DEVELOPED 5%				
1. to experience the use of calculation aids such as abacuses, mechanical calculators, electronic calculators, and electronic learning aids;	Introduction	Expansion	Expansion	Expansion
2. to identify the similarities and differences among computers, calculators, and electronic games.			Introduction	Expansion
IV. HOW TO MAKE COMPUTERS WORK FOR YOU 45%				
1. to use the microcomputer as an interactive tool or learning device;	Introduction	Expansion	Expansion	Expansion
2. to act as a "human turtle" which physically models a Logo turtle's movement;	Introduction	Expansion	Expansion	Expansion
3. to manipulate a "robot turtle";	Introduction		Expansion	
4. to manipulate a Logo "concrete turtle" device;		Introduction		Expansion
5. to manipulate a Logo "screen turtle" using Single Keystroke commands;		Introduction		
6. to experiment with a Logo "screen turtle" in immediate mode;			Introduction	Expansion

	Level K	Level 1	Level 2	Level 3
7. to devise, record, test, and revise a plan for the creation of a design using Logo in immediate mode.				Introduction
V. COMPUTERS IN OUR LIVES 20%				
1. to recognize common devices which use microchips in the home, in the school, and in the community;			Introduction	Expansion
2. to recognize uses and users of computers or computer-supported applications in the community;			Introduction	Expansion
3. to experience the use of computers in recreation.			Introduction	Expansion

program implementation

HARDWARE

The 1983/84 Survey of Computer Hardware in Manitoba schools indicates that approximately three quarters of all Manitoba schools use computers in the teaching and learning process. The annual increase in the amount of computer hardware in Manitoba schools results in a corresponding decrease in the provincial student-to-computer ratio which stands at 60:1 for 1983/84.

As a result of pilot teacher observations it is recommended that K-3 Computer Awareness classes have access to at least one microcomputer with a high resolution colour monitor, disk drive, graphics tablet, and printer. The colour monitor is essential for effective use of primary software which is often colour-dependent. The disk drive is essential for quick, easy, and reliable loading of software. The graphics tablet allows the early years student access to the microcomputer without using the keyboard. The printer might be shared within the school but should be available to allow the production of hard copies of student work. In addition, the microcomputer should be capable of producing both upper and lower case print as appropriate for primary students.

Other hardware devices that would aid in the successful implementation of K-3 Computer Awareness include robotic devices such as the Tasman Turtle, Turtle Tot, or Big Trak and alternative input devices such as paddles, joysticks, Koala pad, or Muppet Learning Keys. The teacher should be aware that special software is required to operate these devices.

There are a number of possibilities for placement of computer hardware within the school depending upon how many microcomputers are available and upon the need to share these. In all cases, placement should remain flexible to accommodate the changing needs within an elementary school. There are many strategies for the placement of computer hardware within a school.

1. Microcomputer(s) Permanently in the Classroom. Pilot teachers have indicted that the ideal situation would be to have at least one microcomputer in the classroom at all times.

2. Microcomputer(s) Moved into and out of Classroom. The most common means of sharing with other teachers is to have the microcomputer system move from room to room. The system is placed on a wheeled cart which should have a raised edge to prevent components being knocked off accidentally.

3. Microcomputer(s) in a Central Area.
   Although the physical location of the computer(s) within the primary classroom was preferred by the pilot teachers, some schools may place their microcomputer(s) in a central area. This central area could be the library, a "computer classroom" or some other supervised area.

GENDER EQUITY

The use of microcomputers in the schools has been seen as a potential equalizer of high-tech opportunity for both girls and boys. This potential can only be realized if teachers balance their choice of educational courseware between that appealing to boys and that appealing to girls; if teachers provide positive computing experiences for both sexes; and if both female and male students learn to use the computer as a tool.

Teachers of K-3 Computer Awareness should ensure that computer activities provide a positive experience for both boys and girls and that students of both sexes have equal access to the computers in the primary classroom. Procedures for ensuring that every student gets a turn, that pairs of students working together learn to share equally, that aggressive students do not push aside more hesitant ones, and that computer access is not provided only for the gifted or to the slower learner are all important considerations. In addition, primary Computer Awareness teachers, who themselves are female, have an excellent opportunity to provide a positive role model for girls in their classes.

Students who learn to use the microcomputer as an applications tool to create graphic, musical, and written compositions or who learn to program the microcomputer in the non-threatening environment of the Logo language, are placing themselves in control of their computing experience. Teachers of K-3 Computer Awareness should ensure that both girls and boys have these opportunities and that primary computing experiences portray the microcomputer as a general purpose, gender-neutral, intellectual tool. In addition, materials used in K-3 Computer Awareness should not reinforce sexual stereotypes, nor should they contribute to the image of the computer as being male or for males only.

Primary teachers will find in taking the precautions discussed earlier that boys and girls will use computers equally in the early grades and at the same time will lay the foundations for gender equity in future computer studies.

SPECIAL NEEDS

The mainstreaming of students with special needs into the regular primary classroom necessitates special considerations on the part of educators. Through the use of individualized computer-based courseware, educators can accommodate many of these special considerations. The K-3 Computer Awareness interim guide considers three general classes of special needs students; the slower learner, the handicapped/disabled, and the gifted.

The slower learner should be encouraged by the teacher to join in classroom computer awareness activities. However, provision should be made for the slower learner to have additional hands-on time with appropriate courseware. The use of quality courseware can be highly motivating for the slower learner by presenting basic facts in new and different ways. Through random selection or random generation, a single piece of courseware can present similar yet different problems or questions each time it is used. The immediate feedback and interaction of the courseware has been found to keep the student on-task and engaged for longer periods of time than traditional methods.

The teacher should find that a greater degree of individualized instruction can be provided for the slower learner through the use of educational courseware than is possible through the use of other instructional media. The teacher may be able to customize the courseware by setting the limits for problems to be presented to the student as well as the level of mastery to be achieved. Success at an appropriate level of difficulty may lead to increased personal self-esteem and motivation.

The handicapped/disabled student should be encouraged to participate in the class activities of K-3 Computer Awareness as much as possible given the nature of the handicap/disability. Modifications may have to be made in order to allow the handicapped/disabled student access to the microcomputer hardware.

Various devices are available which adjust the kind of input accepted by the microcomputer. These include plexiglass masks which cover the keyboard to prevent accidental keystrokes by students lacking in fine motor control or coordination. Touch sensitive screens, joysticks, head sticks, braille keyboards, voice-activated input devices, trackball devices, aspiration devices, Bliss symbolic keyboards, and button boxes are other examples of tools which can make the microcomputer accessible to the student with a handicap/disability.

On the other hand, various devices are available which adjust the nature of the output produced by the microcomputer. These include magnifying devices, printers which produce enlarged text for the visually impaired, and speech synthesizers or Braille embossers for the blind student.

The achievement of control over a microcomputer may improve the self-image of the handicapped/disabled student. The teacher should consider training such a student to use the microcomputer before introducing it to the rest of the class.

The microcomputer and appropriate educational courseware can be used to enrich the learning environment of the gifted student. Quality courseware can challenge a gifted student to employ creative problem-solving techniques involving hypothesis, analysis, synthesis, and deduction. Electronic databases can assist the gifted student in the organization, manipulation and retrieval of information. Word processing software can encourage the students to revise and edit written work, producing a clean copy with little effort after rewriting is complete. Tutorial courseware can enhance learning experiences in a lateral direction without taking the student to material, concepts, or skills that will be covered in succeeding years. Computer simulations can allow the gifted student to become immersed in life-like situations and to experiment with real-life processes without leaving the classroom. Graphics-based computer languages can be used by the student to explore turtle geometry and to begin to develop the top-down technique of computer programming.

STUDENT EVALUATION

Generally, evaluation is conducted to determine how well a student has mastered the knowledge and has acquired the skills and attitudes contained within a program of studies. On this basis, a meaningful evaluation of student participation in K-3 Computer Awareness must be based on student exposure to the particular objectives found within this guide. At the primary level it is recommended that a student be evaluated informally rather than by using more formal techniques.

One informal method of evaluation is teacher observation. The teacher may observe the extent to which a student participates in class discussions, the degree of student initiative in researching and sharing information and materials, and the ability of a student to verbalize concepts and skills.

Such observation could seek answers to the following questions:

- Does the student feel comfortable with and enjoy using a microcomputer?
- Is the student able to work independently on a microcomputer?
- Does the student cooperate with other students in the use of a microcomputer?
- Does the student engage in discussion of computer-related topics?

- Does the student demonstrate an understanding of computer use in the home, school, and community?

Another method of student evaluation is the anecdotal record. The anecdotal record contains short notes by the teacher recording a change in attitude, the development of understanding, as well as evidence of the application of knowledge to new situations. The teacher can conduct short discussions with individual students or small groups in order to acquire this information.

Another useful evaluative tool is a student file which contains a collection of work gathered over time. Such a file may indicate important changes in the knowledge, skills, or attitudes of the student with respect to computer technology. The information in the student file can be reported to parents or displayed during a parent's visit to the classroom.

It is recommended that computer awareness activities be integrated into core subjects of the primary curricula. Where such integration has occurred evaluation should be in the core subject rather than in computer awareness.

Pilot teachers did not recommend formal testing of K-3 Computer Awareness. However, if some formal testing is required, a checklist may be used. Such a checklist may be used to determine whether or not a grade two or three student has the technical skill necessary to receive a "Computer Operator's License". This license, when granted, would allow a student use of a microcomputer without direct adult supervision.

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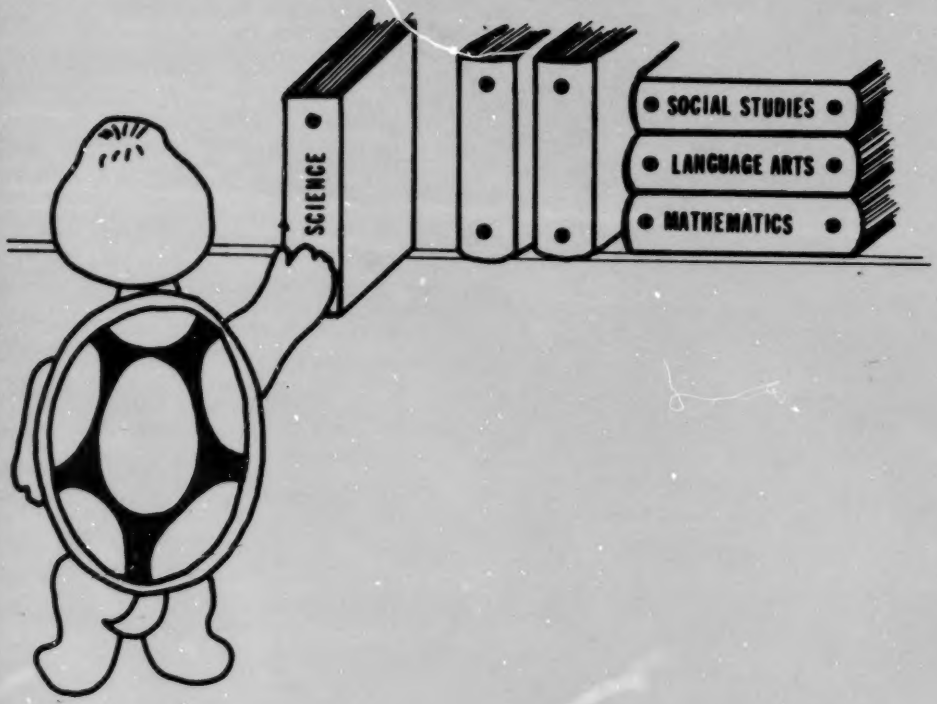
integration



INTEGRATION

It is recommended that K-3 Computer Awareness be integrated with other primary curricula. The K-3 Computer Awareness Integration Chart was prepared by committee members to assist teachers wishing to develop a thematic approach. Such an approach allows the content and concepts of other subject areas to be integrated with computer awareness.

The primary Language Arts, Mathematics, Science, and Social Studies guides were consulted to determine which concepts and skills are taught at each level. Those skills and concepts matching with the stated objectives of the Computer Awareness activities were identified in the chart. Teachers who require an indepth explanation of the identified concepts or skills should refer to the appropriate subject area guide for clarification.

The K-3 Computer Awareness Integration Chart is a matrix of the subject areas and the Computer Awareness activities identifying where integration can occur. Each activity is listed vertically along the left-hand side of the page according to code, title and level.

The subject areas of Language Arts, Mathematics, Science and Social Studies follow across the top. Where integration of a specific Computer Awareness activity occurs with a particular subject area, the concept or skill is identified in the matrix. For example, Activity I-2-1, Computer Parts, Level 1, is an activity which matches with Language Arts in the areas of "vocabulary development" and "visual identification" and which matches with Science in the area of "identification". The teacher can use such information to plan an integrated lesson in Language Arts or Science.

The term "hands-on", which appears in the K-3 Computer Awareness Integration Chart, refers to the fact that the students are required to manipulate specific equipment to achieve the desired outcomes. The term "teacher utility" means that particular activity has been provided to aid the teacher in creating an expanded activity or in demonstrating a concept for students. It is not intended to be used directly by all students.

Discussion with pilot teachers revealed that the use of integration for K-3 Computer Awareness is the most viable method of including computer-based content in the primary curricula. Integration provides a powerful tool which assists classroom teachers in providing computer awareness in their own classrooms. Using this approach, teachers do not have to rely on outside "experts" or resource persons in order to implement K-3 Computer Awareness successfully.

K-3 COMPUTER AWARENESS INTEGRATION CHART

ACTIVITY	TITLE	LEVEL	LANGUAGE ARTS	MATHEMATICS	SCIENCE	SOCIAL STUDIES	OTHER
I-1-1	Learning the Keyboard	1-3	.visual identification				
I-1-2	Typewriter Keyboard Skills	1	.visual identification				.fine motor skills
I-1-3	Computer Keyboard Skills	2	.visual identification				.fine motor skills
I-1-4	More Computer Keyboard Skills	3	.visual identification				.fine motor skills
I-1-5	Computer Keyboard Activity Card	2,3					.teacher utility
I-2-1	Computer Parts	1	.vocabulary development .visual identification		.identification		
I-2-2	De-Bug	1	.sight words		.comparing	.group interaction	
I-2-3	Diskette Care Posters Level K	K	.visual communication .oral language				

ACTIVITY	TITLE	LEVEL	LANGUAGE ARTS	MATHEMATICS	SCIENCE	SOCIAL STUDIES	OTHER
I-2-4	Diskette Care Posters Level 1	1	.visual communication .oral language				
I-2-5	Diskette Care Posters Level 2	2	.visual communication .oral language			.living with technology	
I-2-6	Diskette Care Posters Level 3	3	.visual communication .oral language				
I-2-7	Cassette Care	2	.visual communication .oral language			.living with technology	
I-2-8	Happy or Sad? Diskette	3	.reading comprehension .visual interpretation				
I-2-9	Happy or Sad? Cassette	3	.reading comprehension .visual interpretation				
I-3-1	Starting Steps	2	.visual communication .reading comprehension		.ordering		

ACTIVITY	TITLE	LEVEL	LANGUAGE ARTS	MATHEMA ICS	SCIENCE	SOCIAL STUDIES	OTHER
I-3-2	"Booting" Microcomputers	3	.reading comprehension		.ordering	.group interaction	
I-3-3	Computer Poetry	2	.literature .oral language .writing				.teacher utility
I-4-1	Timetable for Microcomputing	2,3		.telling time	.communication	.group interaction	.teacher utility
I-5-1	Computer Learning Centre	K-3	Potential for integration in many primary subject areas.				
I-5-2	Proficiency Checklist	3					.teacher utility
I-5-3	Computer Operator's License	3					.teacher utility
II-2-1	Name Game	2	.visual identification		.classification		
II-2-2	A. B. Computer Words	3	.alphabetization				
II-2-3	Input-Processing-Output	2	.oral language	.problem solving	.classification		.teacher utility
II-2-4	Input-Output	3	.spelling				
II-2-5	Computer Construction	2	.puppets				.Art
II-3-1	Peanut Butter and Jelly	2,3	.writing .oral language .sequencing			.group interaction	.teacher utility

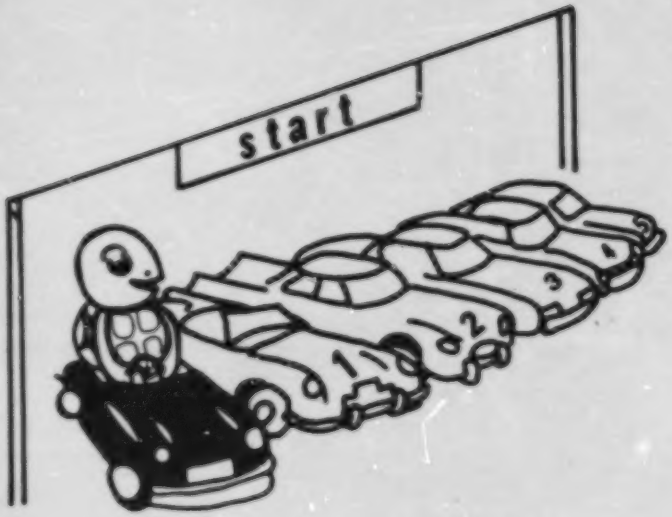
ACTIVITY	TITLE	LEVEL	LANGUAGE ARTS	MATHEMATICS	SCIENCE	SOCIAL STUDIES	OTHER
II-3-2	Does It Float?	3	.writing .sequencing		.observation .classification .experimentation		.teacher utility
II-3-3	Order Please!	2,3	.visual communication				.teacher utility
II-4-1	Demonstration Computer Programs	2					.teacher utility
III-1-1	Calculator Definitions I	2,3	.spelling .vocabulary development				.hands-on
III-1-2	Calculator Definitions II	3	.spelling .vocabulary development				.hands-on
III-1-3	Mrs. Duck's Surprise	2	.reading comprehension				.hands-on
III-1-4	Calculator Storybook	3	.vocabulary development .writing .oral language			.group interaction	.hands-on
III-1-5	Calculator Addition	3		.number theory .addition			.hands-on

ACTIVITY	TITLE	LEVEL	LANGUAGE ARTS	MATHEMATICS	SCIENCE	SOCIAL STUDIES	OTHER
III-1-6	Calculator Magic	3		.addition .subtraction .multiplication .division			.hands-on
III-1-7	Computer Counting	2		.counting .measuring			.teacher utility
III-2-1	Can-Cannot Stories	3	.writing		.observation .description		
IV-1-1	Video Drawing	2,3		.shapes			.teacher utility
IV-2-1	My Home	K					.Logo .teacher utility
IV-2-2	Simon Says	K					.Logo
IV-2-3	Turtle Hat	1					.Logo
IV-2-4	Turtle Treasure	1					.Logo
IV-2-5	Planning Pictures	2					.Logo
IV-2-6	Human Turtle Travels	3					.Logo .teacher utility
IV-3-1	Turtle Robots	K					.Logo

ACTIVITY	TITLE	LEVEL	LANGUAGE ARTS	MATHEMATICS	SCIENCE	SOCIAL STUDIES	OTHER
IV-3-2	Robot Attributes	2	.visual identification	.sorting	.observation .classification		
IV-3-3	Tasman Turtle	2	.vocabulary development		.observation		
IV-3-4	Robots	2	.oral language .literature .writing		.prediction	.living with technology .coping with change	
IV-3-5	Turtle ABC's	2					.Logo
IV-4-1	The Pond	1			.comparing .living and non-living		.Logo
IV-5-1	Doodling Turtles	1					.Logo .teacher utility
IV-5-2	Creating Doodling Turtles	1					.Logo .teacher utility
IV-6-1	A-Maze-ing Turtles	2		.estimating			.Logo .teacher utility
IV-7-1	Designer Turtles	3					.Logo

ACTIVITY	TITLE	LEVEL	LANGUAGE ARTS	MATHEMATICS	SCIENCE	SOCIAL STUDIES	OTHER
V-1-1	Microchips Around Us	2,3	.oral language .vocabulary development			.living with technology .coping with change .community life	.teacher utility
V-2-1	A Computer Play in 3 "Bytes"	2,3	.oral language .drama			.living with technology .coping with change .community life	

program outline



UNIT I GETTING STARTED! 10%

This unit is intended to give the teacher and students hands-on experience as an introduction to the use of the microcomputer in the classroom. Procedures for the care, handling, moving, and scheduling of the microcomputer are discussed. Since teachers should begin computer awareness with hands-on microcomputing experiences, it is recommended that the class have access to at least one microcomputer in order to achieve the objectives of this unit.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

The student should be able:

1. to identify and to use appropriate keys on the microcomputer keyboard.
   (Level K-Introduction)
   (Level 1-Expansion)
   (Level 2-Expansion)
   (Level 3-Expansion)

Teachers are advised NOT to wait until this objective is achieved before continuing to use the microcomputer in the classroom. Rather, in beginning computer awareness by using appropriate primary level educational courseware, the students will be exposed in a concrete way to the microcomputer. This early exposure will lay the foundations for future computer awareness activities.

* Refer to the Resource Materials section of this guide to identify appropriate courseware with which to begin the computer awareness program.

* At the Kindergarten level the students should be exposed to courseware which allows alternative methods of input such as the mouse, joysticks, paddles, or graphic tablets such as the Koala Pad or Muppet Learning Keys.

The microcomputer keyboard consists of alphabet keys, number keys and special keys which are learned during the primary years as the need arises. A diagram of the keyboard layout for selected microcomputers is included in the activity section of this guide. Others may be found in appropriate microcomputer manuals.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
	* Using the appropriate keyboard diagram for your microcomputer, run off enough copies of the KEYBOARD LAYOUT for each student. Have the students identify the location of the most frequently used keys such as space bar, RETURN or ENTER key, the letters in their name, the digits in their telephone number, etc., using the microcomputer keyboard as an aid. If this activity is used at Level 1, it could be done in small groups rather than individually.	I-1-1 LA
	* If available, old typewriters could provide additional opportunities for the students to become familiar with the keyboard. Simple keyboarding skills, such as using the index finger of the left hand to press keys on the left side of the keyboard and using the index finger of the right hand to press keys on the right side of the keyboard could be introduced.	I-1-2 LA/Fine Motor Skill
	Provide time for all students to have "hands-on" experience with the microcomputer. At Level 2 assign two students at a time to experiment with the microcomputer <u>without</u> the use of prepared software. Have simple keyboard activities printed on cards to direct the students in their exploration. When students use the microcomputer in this way, they should be told <u>NOT</u> to press the RETURN key, otherwise the message "SYNTAX ERROR" will appear. To advance to the next line, students should hold down the space bar or press it repeatedly until the cursor reaches the desired position. The teacher should refer to the microcomputer manual to determine how to clear the screen between activities.	

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OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
	* A number of cards, such as those in Activities I-1-3 and I-1-4 which range from simple to complex and from familiar to novel, could be used to guide students using the keyboard. The teacher may expand this activity by showing various patterns of numbers, letters, pictures, and symbols appropriate to the class. If a printer is attached to the microcomputer, the contents of the screen may be printed out. This is called a "screen dump."	I-1-3 LA/Fine Motor Skill I-1-4 LA/Fine Motor Skill
	* Activity I-1-5 provides an activity card format suitable for copying.	I-1-5 Teacher Utility
	* At Level 3, allow students to learn the keyboard using activities such as alphabet races. With the students working in pairs, have one student see how many letters he/she is able to type in alphabetical sequence in two minutes while the other student times the activity. Races on the keyboard could be varied using only vowels, only consonants, or current reading vocabulary words, as appropriate for the students.	
	* Numbers on the keyboard can be learned in a similar fashion substituting the question, "How high can you count in two minutes?"	
	The following software could be used to reinforce keyboard familiarization: . TRS-80 "ALPHABET" by Bertamax or Radio Shack; . COMMODORE "Letters and Numbers" by Teaching Tools; . APPLE "Talk" or "The Friendly Computer" by MECC (#703, #779); . "NUMTYPE" by Manitoba CAL Consortium; . "STICKYBEAR NUMBERS" or "STICKBEAR ABC,s" by Xerox.	

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
2. to identify the major parts of a microcomputer system and to demonstrate adequate care of those parts in the classroom; (Level K-Introduction) (Level 1-Expansion) (Level 2-Expansion) (Level 3-Proficiency)	After students have had some concrete hands-on experience with microcomputers, they should be exposed to the proper vocabulary in naming the parts of a microcomputer system. Parts of a microcomputer to be identified include keyboard, screen/monitor, disk drive or tape drive as appropriate, diskette or cassette as appropriate, and printer.	
	* Affix labels to the parts of the microcomputer and/or to a large poster representation of it. Use any of your regular word card games and activities to help students remember these terms.	I-2-1 LA/Sc
	* Play "DE-BUG," the computer version of "Old Maid," using the cards provided in Activity I-2-2. The cards could be pasted on cardboard for durability or a set laminated for classroom use. Other variations on the card game theme are "Snap," "Fish" or "Concentration."	I-2-2 LA/Sc/SS
	After students have had some concrete hands-on experience with the microcomputer, rules relative to the care of diskettes, tapes, and microcomputers should be discussed with the students. Consider for example, guarding against heat and cold extremes, bending, water, food, dust, etc. The teacher should ensure that diskettes or tapes are never left on top of the microcomputer, monitor/television set, disk drive, or cassette recorder.	

The teacher should show students how to ground themselves to dissipate static electricity by touching any piece of unpainted metal before using the computer equipment including diskettes and cassettes. This could be called "de-sparking."

* The teacher could use the diskette handling and storage posters from Activities I-2-3 to I-2-6 to begin a discussion with students concerning proper care procedures. — I-2-3 LA, I-2-4 LA

* The teacher could construct a model of a diskette and envelope which students could use in demonstrating proper handling of diskettes. — I-2-5 LA/SS, I-2-6 LA

The same careful handling procedures apply to cassettes. — I-2-7 LA/SS

CARE OF DISKETTES, CASSETTES, AND MICROCOMPUTERS: BACKGROUND INFORMATION

Diskettes

The students should know that diskettes must be handled carefully, that the oval opening on the diskettes must not be touched, that diskettes can be destroyed by bending or rough handling, that diskettes must be kept away from extreme heat or cold, that diskettes should be stored in containers free of dust and that they are not to be left lying around.

Cassettes

The students should know that cassettes can gather dust which may damage the tape and the drive, that cassettes should be properly put away in a container, that the tape can be stretched if started

and stopped in the middle of loading, that the tapes should be rewound before putting away, and that extremes of heat or cold may cause damage.

Microcomputers

The students should know that food and water must be kept away from the microcomputer, that water or any liquid spilled on the keyboard can ruin the microcomputer, that the microcomputer should not be touched when not in use, and that the microcomputer should be kept away from very dusty or very warm places. Students (especially those working in carpeted areas) should make it a habit to ground themselves ("despark") before starting to use the microcomputer to prevent static electric sparks which can damage the microcomputer.

* An initial orientation in the form of explanation, demonstration, and discussion could be used to introduce the topic of care with regard to microcomputers and to recall those ideas for students who may have discussed this topic before. — I-2-8 LA, I-2-9 LA

Students could brainstorm for ways of demonstrating their knowledge of the care for microcomputers. Some ideas:

* The students could conduct a simple science experiment which deals with the effects of heat on plastics. For example, place an old audio record in a hot oven to see how it warps. This is similar to what happens if a computer diskette is exposed to heat.

* The students could conduct a simple science experiment which deals with what happens when you stretch things. For example, try stretching a green garbage bag out of shape to demonstrate that it does not return to its original shape. This is similar to what happens if a computer cassette tape is stretched.

* The students could conduct a simple science experiment which involves playing an old scratched record to show how the sound information becomes distorted. This is similar to the way computer information contained on a diskette can become distorted if the diskette is scratched.

* Level 1 students could design and draw posters which explain the care of computers and diskette or cassettes. These could be displayed in the classroom or in the school hallways.

* Level 1 students could make a chart-sized class book on computers and include the care of microcomputers as one topic.

* Level 2 students could make puppets and prepare a puppet show to explain the importance of caring for computer materials.

* Level 2 students could write a song or poem about proper care of microcomputers and compose some music to go with it. The music teacher and/or classroom teacher may do the composition as part of a music class. The music could range from rhythm instruments to a computer music composition.

* Level 3 students could put together a "Road Show" in which they combine their knowledge of the care of microcomputers and share it with students in other grades. The sharing could take any form-from an oral presentation by the students to simply a display of their projects.

* Level 3 students could combine Science and Language Arts in the form of a research project which might examine some of the concepts previously mentioned. The project could be developed following the writing process of prewriting, writing, editing, and final product as outlined in the Language Arts Curriculum.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

3. to show how to switch on a microcomputer under adult supervision;
   (Level 1-Introduction)
   (Level 2-Expansion)
   (Level 3-Proficiency)

The student is not expected to turn the microcomputer "on" or "off" independently but only to perform these tasks under adult supervision.

It is suggested that all the components of the microcomputer system be plugged into a power bar containing a switch. The power bar should always be plugged into a wall socket, the microcomputer system components should always be turned on at the source and the power bar switch should be used to turn ON/OFF the entire system. It should be noted that PET and TRS 80 diskettes should never be in the disk drive when the power is turned ON or OFF although APPLE diskettes may be.

The teacher should ensure that the disk drive is left OPEN when not in use. This allows the mechanism within the disk drive to "relax."

* The student could watch the teacher demonstrate the "turning-on" routine and could learn the routine using the following suggestions. The student could individually practice turning the machine on and off, under trained supervision and receive an appropriate teacher/school/division-made certificate for, say, three successful unprompted demonstrations of the process.

* The teacher (and/or class) can create a chant (a simple rhyming of the steps to turn on the computer) to practice daily as a language arts activity.

* Practice could be varied using the following techniques:

  . choral chanting as a group,
  . chanting line by line in sequence, with individual students each chanting one line in turn,
  . group guessing of the correct sequence through individual student pantomime of each step,
  . demonstrating the process while reciting the verse(s).

I-3-3
LA/Teacher
Utility

* A SAMPLE CHANT (use it as a stimulus to create your own):

"Our computer is an Apple II
Let's see what you can make it do.
First touch shiny metal so you will know
That you're de-sparked and it's safe to go.
Th . . . e . . . n
Put the diskette in the drive
Close the door and make these come alive
The monitor, power, and CPU.
The red light goes out, and it's all up to you."

To power-up the system or to "boot" means to be able to turn the microcomputer on. This procedure will be different from one microcomputer to another. The teacher should consult the Operator's Manual for the particular microcomputer to be used in the classroom. Steps for "booting" APPLE, PET, and TRS-80 microcomputers follow:

I-3-1
LA/Sc
I-3-2
LA/Sc/SS

Steps for "Booting" an APPLE Microcomputer

1. Ground yourself.
2. Turn on the monitor.
3. Insert the diskette face up into the slot in the disk drive.
4. Close the door of the disk drive.

5. Turn on the power switch at the back of the microcomputer.
6. Wait until the red light on the front of the disk drive goes off for the first time.
7. Now make your program selection from the menu on the screen.

MENU-DRIVEN Software automatically handles the cataloguing, loading, and running procedures and produces a "menu" from which program selections are made.

Note: When turning the Apple off, check to see that the red light on the disk drive is off, remove the diskette, turn off the computer, and then the monitor.

The following steps are necessary only if the software is NOT menu-driven.

8. Type the word CATALOG. Press <RETURN>.
9. The catalog or menu will appear on the screen.
10. Type LOAD and the name of the program you wish to run. Press <RETURN>.
11. Type RUN. Press <RETURN>.

Steps for "Booting" a PET Microcomputer

1. Ground yourself.
2. Turn on the PET microcomputer.
3. Turn on the disk drive.
4. Insert the diskette face up into the slot in disk drive number zero.
5. Close the door of the disk drive.
6. Press <SHIFT> and <RUN/STOP> at the same time.
7. Now make your program selection from the menu on the screen.

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MENU-DRIVEN Software automatically handles the cataloguing, loading, and running procedures and produces a "menu" from which program selections are made.

When turning the PET microcomputer system "OFF," the preceding steps should be followed in reverse, starting at number five, otherwise damage may result to the software or the hardware.

The following steps are necessary only if the software is NOT menu-driven.

8. Press <RUN/STOP>.
9. Type CATALOG and press <RETURN>.
10. Select the program you wish to use. Note the exact spelling of its title.
11. Type LOAD "name of the program", 8 and press <RETURN>.
12. Wait until the word READY appears and the blinking cursor returns.
13. Type RUN and press <RETURN>.

Steps for "Booting" a TRS-80 Microcomputer

1. Ground yourself.
2. Turn on the power switch under the right side of the keyboard.
3. Wait until the red light on the disk drive goes off.
4. Insert the diskette face up into the slot in the bottom disk drive.
5. Close the door of the disk drive and press the orange (RESET) button.
6. Wait until the red light on the disk drive goes off and then press the orange (RESET) button again.
7. Now make your program selection from the menu on the screen.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
	MENU-DRIVEN software automatically handles the cataloguing, loading, and running procedures and produces a "menu" from which program selections are made. Note: To turn off the TRS-80, check to see that the red light on the disk drive is off, remove the disk, and turn off the computer. The following steps are necessary only if the software is NOT menu-driven. 8. When you see the words "TRSDOS READY" on the screen, type DIR and press <ENTER>. 9. Select the program you wish to use. Note the exact spelling of its title. 10. Type RUN "name of the program" and press <ENTER>.	
4. to demonstrate the classroom rules for the use of the microcomputer; (Level 1-Introduction) (Level 2-Expansion) (Level 3-Proficiency)	If the microcomputer is portable from classroom to classroom, then moving procedures will need to be established in order to transport the microcomputer safely. If the microcomputer is within a laboratory, then the rules of the lab will need to be established for safe, orderly and effective use. Whether the computer remains stationary or is moved about, classroom rules should be established with regard to scheduling, usage procedures and classroom management. These will vary with each lab or station, and within individual classrooms.	I-4-1 Math/Sc/SS/ Teacher Utility

Rules can be written on chart paper and placed in the lab, or they may be placed directly on the moving carts or in classrooms close to where the computer will be used. As with any rules, it is advantageous for students to feel that they participated in setting the rules as they are more likely to follow rules which they understand and helped to develop.

Directions concerning moving and storing should be posted on the wall near where the microcomputer is kept or on the cart. A diagram showing placement of items on the cart may be helpful.

MOVING PROCEDURE (if applicable)

The teacher should observe the following precautions when moving the microcomputer:

- Check to see that the power cords are unplugged from the outlets.
- Check to see that all cords and attachable hardware are secured in the proper places before moving.
- Push the cart carefully and only under clear vision in order to prevent collision with people or objects, and to prevent anything falling from the cart while moving.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

Suggested activities include:

* Brainstorm for ways of remembering and displaying classroom computer rules concerning Care, Courtesy, and Caution. By involving the students they are more likely to abide by the rules and also they will learn why certain rules are necessary. The age of the students will determine how much input needs to come from the teacher.

* Have students make large wall charts or individual cards to be placed on carts to illustrate their classroom computer rules.

* Write a story about what could happen if there were no classroom rules. Such stories could range from an experience story in Grade One to an adventure story complete with illustrations for older students. The teacher may wish to use a word processing program to write the story.

* Let the students make charts or think of ways to keep track of whose turn it is to use the microcomputer.

5. to demonstrate the procedures to follow if trouble is encountered in the operation of the microcomputer system.
(Level K-Introduction)
(Level 1-Expansion)
(Level 2-Expansion)
(Level 3-Expansion)

It is recommended that teachers enlist the help of a teacher aide, student-teacher, parent volunteer or student proctor (older student helper) to act as a resource person.

When trouble is encountered in the operation of the microcomputer system, the student should be encouraged to call a teacher or resource person for assistance, rather than attempting to fix the problem him/herself.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
	* The teacher could set up a "computer learning centre" in the classroom or the resource centre which could contain: . the microcomputer(s) . the diskettes or cassettes to be used by the students . activity cards . a schedule for using the microcomputer . a clock or egg timer . children's computer work . lists of instructions for various procedures . an old typewriter	I-5-1 LA/Ma/Sc/ SS/Other
	* Once students have had sufficient hands-on experience in operating the classroom microcomputer, they could be tested using the Proficiency Checklist (Activity I-5-2) and if found to meet the checklist criteria, be issued a "Computer Operator's License" (Activity I-5-3).	I-5-2 Teacher Utility I-5-3 Teacher Utility

II. WHAT IS A COMPUTER? 20%

This topic is intended to increase student awareness of how a computer works through student interaction with exemplary educational courseware. Emphasis is placed on achieving understanding of the INPUT/PROCESSING/OUTPUT sequence and of procedural thinking. Access to a microcomputer is recommended.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
The student should be able:		
1. to understand that a computer is a machine with which a person can interact; (Level K-Introduction) (Level 1-Expansion) (Level 2-Expansion) (Level 3-Expansion)	The computer is different from many other machines such as movie projectors, video tape recorders, audio tape recorders, record players, and televisions in that through a computer program, a person can interact with a computer. To reinforce the fact that a person can interact with a computer, allow students to use educational courseware such as simulations, educational games, and courseware that supports discovery-learning and problem solving. The teacher should refer to the Resource Material section of this guide to identify appropriate educational courseware. The use of high quality educational courseware should be an ongoing part of the entire K-3 Computer Awareness experiences.	
2. to relate the major parts of the microcomputer to the Input - Processing - Output sequence; (Level 2-Introduction) (Level 3-Expansion)	With respect to the microcomputer, examples of "INPUT" devices are keyboard, graphics tablet, joystick, disk drive, and tape recorder. Examples of "OUTPUT" devices are video screen, printer, or audio speaker. Examples of "STORAGE" media are the diskette or cassette. The teacher could use the words INPUT, PROCESSING, and OUTPUT when describing everyday happenings. For example: INPUT - DIRTY TEETH PROCESSING - BRUSHING OUTPUT - CLEAN TEETH	II-2-1 LA/Sc II-2-2 LA

Such examples should help students to understand the INPUT - PROCESSING - OUTPUT sequence of the microcomputer. II-2-3 LA/Ma/Sc/ Teacher Utility

* Have students make posters or create plays illustrating INPUT, PROCESSING and OUTPUT for activities such as cutting hair, freezing water, or making a picture.

* Have students in groups of three create one page of a three-strip-flip booklet. One student from each group draws the input (dirty dishes), one draws the processing (sink), and the third draws the output (clean dishes) on separate cards (one-third the size of a three-ring binder page). The cards in each category are shuffled and placed vertically in the three-strip-flip booklet (a three-ring binder may be used for this purpose). The completed booklet could be placed in a computer centre and students could use it to reinforce their concepts of INPUT, PROCESSING, and OUTPUT.

* Make picture dictionaries of computer parts and relate these to the input - processing - output sequence. Have the students list all their computer words on separate pages. Draw a picture representing each word on the page or print a simple "definition." Later, these pages could be classified under the headings "INPUT" or "OUTPUT."

* Word search programs are available for most microcomputers. These programs produce word search puzzles like those found in Activity II-2-4. Use one of these programs to make a word search with the names of the students in the class. Explain the Input - Processing - Output sequence illustrated by typing in the words, the computer arranging these in a puzzle, and the printer typing out the puzzle. II-2-4 LA

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

* A fill-in-the-blanks game such as the following could be devised and played.

INPUT	PROCESS	OUTPUT
wrecked car	repairing	_____
long hair	_____	short hair
_____	freezing	ice

* Have each student create his/her own computer using a milk carton covered in tin foil. Allow the students to be as creative as they wish by adding a keyboard, disk drive, printer, and by embellishing their work with buttons, pipe-cleaners, paint, etc. — II-2-5 LA/Art

3. to arrange a series of steps in a sequence to form a procedure;
(Level 1-Introduction)
(Level 2-Expansion)
(Level 3-Expansion)

A person's use of step-by-step procedures to complete everyday tasks is actually very similar to the use of step-by-step algorithms for arriving at solutions to problems in both computer programming and mathematics. No procedure can be outlined without a clear understanding of the task or problem to be solved. The actual task of following a stated procedure requires logical and systematic thinking.

Activities should be designed to give students an opportunity to recognize the "programming" that they already do and to sharpen their organizational, planning, and analytical skills in preparation for actual computer programming activities. It is important to use the students' real experiences as the basis for helping them to develop the patterns of thinking and the creative problem-solving skills necessary to program computers.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

* The teacher could emphasize sequencing skills, using everyday activities with which students are familiar, including:

  - dressing
  - brushing teeth
  - sharpening a pencil
  - moving from one part of the school to another
  - negotiating mazes
  - preparing breakfast cereal
  - building a simple Lego project
  - making icecubes
  - baking chocolate chip cookies
  - scrambling an egg
  - folding a paper airplane
  - mailing a letter
  - getting from home to the classroom

A sample activity, II-3-1, Peanut Butter and Jelly, has been provided to help students learn to prepare a written or pictorial sequence to describe a process. — II-3-1 LA/SS/ Teacher Utility

Making numbered lists is a form of ordered thinking which is essential for computer work.

* As an individual assignment or as a small-group brainstorming and chart-recording exercise, have the students organize and state directions for any of the everyday activities noted above. Share the results of each group's or individual student's work emphasizing clarity of directions, order of directions (Is the order fixed or changeable?), etc. Emphasize that there are many possible ways of planning and carrying out steps which have a common result. — II-3-2 LA/Sc/ Teacher Utility

The children should be encouraged to act out their sequences in order to detect and change unexpected results. This "detection and correction" process is called DEBUGGING when applied to computer programming.

As soon as possible the teacher should begin to integrate computer-related vocabulary into classroom activities.

Sequencing skills are a prerequisite to computer programming skills and as such are considered "pre-programming skills."

* The teacher could emphasize sequencing in Language Arts. Most sequencing activities can be integrated into the regular reading program. Activity books for most reading series contain sequencing activities (pictures only, pictures and words, or words only). To provide more in-depth individualized sequencing activities, use teacher-oriented or commercially available materials such as See-Que Puzzles, Developmental Learning Materials or various activities from a reading series teacher's guide.

II-3-3
LA/Teacher Utility

Resource

See-Que Puzzles (Primary School Supplies Ltd., 365 Enford Road, Richmond Hill, Ontario L4C 3G2)

* After the students have had numerous opportunities to experience the sequencing of everyday activities, have them instruct a "Human Robot" (teacher, principal, caretaker, secretary, or parent-volunteer) step-by-step through one of their sequences.

* Have the students create a maze using masking tape on the floor. The "Human Robot" must act as a "dumb" robot and only

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

follow the exact directions as given by the group of students. Allow mistakes to happen and to be corrected (debugged). Have another person record each corrected step on the blackboard, overhead, or chart so that after the successful negotiation of the maze, the class is left with a "debugged" (correct) procedure that will work again and again for that specific maze. Use words such as FORWARD 5 TILES (OR STEPS) RIGHT, and LEFT in the procedure. Allow one student from each group an opportunity to follow this algorithm and to negotiate the maze under the direction of the group members. In the meantime, have the other groups doing seatwork on another maze. Use a seasonal approach for these seatwork mazes, where Santa Claus is delivering toys down the chimney, the Easter Bunny is searching for eggs, etc. Emphasize the importance of directionality where the LEFT and RIGHT of the "Human Robot" working through the maze may be different to the left and/or right hand side of the group members who are not facing in the same direction as their "Human Robot". Encourage students to estimate distance, revising their estimates as required by successive approximations. As a variation, try blindfolding the "Human Robot" or writing the "reverse" procedure which will return the "Human Robot" to its starting point.

4. to recognize that a procedure which allows a computer to perform complex tasks is a sequence of instructions. (Level 3-Introduction)

Now that students have had some experience with sequencing, the teacher should make the correlation between the sequencing that people follow in everyday activities and the sequencing that computers must be programmed to follow. Complex tasks such as printing, calculating, graphics, turtle geometry, and word processing all require a carefully sequenced program.

Students should understand that computers are basically problem-solving machines which serve people in a variety of ways. A

computer does jobs which people want done when a person gives the computer a sequence of instructions it can follow.

A sequence of instructions given to a computer by a person is called a computer program. Giving a computer instructions requires a person to think in special ways and to use a special language which computers can interpret.

* Write simple instructions for students. For example: stand up, say "hello" to a friend, and sit down. Have the students act out the instructions on the command "RUN." Allow the students to pair-off and have them write out instructions for each other. Remind students to do only what the instructions say, to follow the sequence exactly, and to remember that the instructions are written by a person in "person" language.

* To demonstrate that a computer acts only on instructions, turn on the computer, type in RUN and press <ENTER> or <RETURN>. Nothing will happen. Discuss this result with the students - why was there no output. Continue this activity by instructing the students to "make" or "do." The students will probably look confused and question "make what?" Allude to their not being able to "make" because they have no appropriate instructions, just as earlier, the computer could not "run" because it had no instructions. Do variations of this theme until the concept is established.

* The teacher could type the following instructions (short computer program written in BASIC computer language) into the microcomputer:

```
NEW
10 PRINT "the name of your school"
20 GO TO 10
RUN
```

NOTE: In line 10, any one-line message can go between the quotes.

The command NEW is typed at the beginning of each new program. Computer programs contain numbered lines. These numbers are necessary to tell the computer the correct sequence. The command RUN tells the computer to carry out the instructions in the program. In the short sample program, the computer will print continuously "the name of your school" down the left side of the screen. This program will not stop until you press one of the following:

APPLE: <CTRL> and <C> simultaneously
COMMODORE: <RUN/STOP>
RADIO SHACK: <BREAK>

Now to get the original program back on the screen, type LIST. Do not attempt to have the students understand the words but point out that the words are instructions which the computer understands. To re-run this program simply type RUN and press <ENTER/RETURN>.

Discuss the origin of the program which was typed in previously (a person had to write it).

* Teachers could create other computer programs by changing the message within the quotation marks. Individual students could experiment by typing in their own names or messages thus creating their own computer program(s). — II-4-1 Teacher Utility

III. HOW COMPUTERS HAVE DEVELOPED 5%

This topic is intended to expose students to the development of calculation aids from finger calculators to computers. Discussion of this topic is more appropriate at the upper primary grade levels but actual experiences with the various devices are appropriate at all levels. It is recommended that the students be provided with hands-on experience with devices such as abacuses, mechanical calculators, electronic calculators, and electronic learning aids, as well as microcomputers.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
The student should be able:		
1. to experience the use of calculation aids such as abacuses, mechanical calculators, electronic calculators, and electronic learning aids; (Level K-Introduction) (Level 1-Expansion) (Level 2-Expansion) (Level 3-Expansion)	Examples of electronic learning aids are Speak and Spell, Little Professor, etc.	
	* Collect as many working examples as you can of the abacus, the mechanical calculator, the electronic calculator and electronic learning aids and set them up in a learning centre.	III-1-1 LA/Hands-on III-1-2 LA/Hands-on
	* Create a set of task cards for the centre which will involve the students in a meaningful way. For example, prepare a set of laminated addition flash cards. Have students choose partners. One student writes the answer on each card with a non-permanent marker and the other student then checks the answer using a calculator.	III-1-3 LA/Hands-on III-1-4 LA/SS/Hands-on III-1-5 Ma/Hands-on III-1-6 Ma/Hands-on
	The teacher could emphasize the difference in speed and accuracy of calculators and computers as compared with the student's mental arithmetic or paper-and-pencil arithmetic.	

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

* In order to emphasize the counting speed of the computer versus that of the students, the teacher could type the short counting program in Activity III-1-7 into the microcomputer. Once the computer is ready, the teacher could use a stopwatch or a clock with a second hand to time the students and then to time the computer. This could be done in two ways:

III-1-7
Ma/Teacher
Utility

1) How high are the students as a group able to count in one minute? How high is the computer able to count (using the program from Activity III-1-7) in one minute? Compare the highest number the computer reaches to the highest number the students reach.

2) Time the students as they count from one to one hundred, then time the computer as it counts from one to one hundred.

The times are recorded and compared. Emphasis during the discussion following this activity should be on how quickly and tirelessly the computer worked.

* In order to emphasize the accuracy of the calculator versus that of the students, the teacher could stress that the calculator is always accurate whereas people sometimes make mistakes. To allow the students to experience the accuracy of the calculator, they could each be given a short list of calculations, appropriate for their grade level. They would first do the calculations themselves, then use the calculator to check their answers. When all the students have finished checking their answers, the teacher could put a previously prepared chart on the board that displays the questions and the correct answers. A discussion could focus on whether or

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

not the calculator was accurate. It should be pointed out to the students that if the calculator answer does not seem to be correct that human error should be considered. The student then would check to see if the calculation question was improperly printed on the page or if it was improperly entered into the calculator. The final outcome should show the accuracy of the calculator.

2. to identify the similarities and differences among computers, calculators, and electronic games.
(Level 2-Introduction)
(Level 3-Expansion)

The intent of this objective is to have students practice the skills of classifying and categorizing information (as per the Language Arts program) and to engage in higher level thinking skills typified by the questions: "In what ways are these devices similar?" and "In what ways are these devices different?" Consider price, place of use, application, physical appearance, etc.

Consult department store catalogues, computer store catalogues, computer magazines or educational computing journals in order to obtain more information.

* Use bulletin boards, charts, scrap books, collections of advertisements, and other methods of displaying materials to identify similarities and differences among the various kinds of machines. Categories could include price, size, application, place of use, and physical appearance.

* Brainstorm a new machine. Add detail to the final product. Younger students may want to draw/paint their product while some older students may want to create a model (plasticine, toothpicks, clay, cut and glue bristol board, soap/potato carving).

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
	* Brainstorm improvements to an existing machine. Write a class letter about these ideas and send it on primary chart paper in a large envelope to the manufacturer. The teacher and students may wish to send a class letter, decorated by drawings or photographs, autographed by class members or, at a higher level students may wish to send individual letters.	
	* Lead a student discussion concerning differences between computers and people. Identify what is best done by people and what is best done by computers.	III-2-1 LA/Sc
	* Brainstorm a list of specific machines (computers, calculators, or electronic games) which would help people. Find how many students in your room/grade/school have these machines in their homes. Make charts and graphs of this information. Have students orally interpret the graphs and charts.	

IV. HOW TO MAKE COMPUTERS WORK FOR YOU 45%

This topic is intended to prepare students, through the development of problem-solving skills and logical thinking techniques, for future work with computers. The creative thinking skills acquired through the use of computers help to reinforce those used in other areas of the curriculum. Emphasis is to be placed on partial solutions, on debugging, and on discovery-based learning. If possible, students should be provided with hands-on experiences to illustrate appropriate uses of the computer as a tool. Major emphasis is placed on the development of pre-Logo and introductory Logo activities.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
The student should be able: 1. to use the microcomputer as an interactive tool or learning device; (Level K-Introduction) (Level 1-Expansion) (Level 2-Expansion) (Level 3-Expansion)	The use of appropriate educational courseware will give the student the opportunity to interact with the microcomputer. However, if the courseware also relates to a specific teaching topic, then the learning is two-fold. As soon as possible, students should begin to have courseware related activities integrated into the existing primary curriculum in Language Arts, Mathematics, Science, Social Studies, and other subject areas. Primary courseware is available for various models of microcomputers, for various subject areas, and for various grade levels. The teacher should review all courseware before exposing the students to its use. Listed below are some suggested programs from three sources of courseware: (a) commercial courseware, (b) licensed courseware, and (c) public domain software. (a) COMMERCIAL COURSEWARE . Moptown Parade, The Learning Company . Gertrude's Secrets, The Learning Company	

- Memory the First Step to Problem Solving, Sunburst
- The Friendly Computer, MECC
- Facemaker, Spinnaker
- Bumble Plot, The Learning Company
- Instant Zoo, Sesame Street
- Rhymes and Riddles, Spinnaker
- Delta Drawing, Spinnaker
- Elementary Vol. 7 #7:7, MECC

b) LICENSED COURSEWARE

- Manitoba Computer Assisted Learning Consortium or MCAL (TRS-80, PET, APPLE)
- Minnesota Educational Computing Corporation or MECC (Apple, C-64, Radio Shack)

c) PUBLIC DOMAIN SOFTWARE

- Commodore Public Domain Software (PET, C-64)
- Radio Shack Public Domain Software (TRS-80, Colour Computer)
- Apple Public Domain Software (Apple II+/IIe)

In order to accomplish this objective, the teacher should ensure that every student has as much microcomputer interaction time as possible. This computer time need not take place all at once. To arrange for each student to have adequate time, it is important to do some very careful timetabling. Any timetable should be flexible and should be reviewed periodically to ensure its appropriateness. This is particularly important if you have a "travelling" computer and various staff members are involved. Timetabling techniques will vary with the number of computers to which the class has access and with the location of the microcomputers.

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If your school has only one microcomputer, a master timetable should be drawn up. A short term timetable should be made by each teacher in order to ensure that each student has as many opportunities as possible to use the educational courseware. Usually a time span of ten to fifteen minutes is sufficient to complete a courseware program. The teacher should determine the length of the program, decide how many times it could be completed in the available time, and plan the day accordingly.

Students may work individually, in pairs, or in small groups at the microcomputer. However, pilot teachers found that the peer interaction and sharing which occurs when students work in pairs at the microcomputer is very valuable and makes optimum use of the computer time available.

In order to limit the number of interruptions for the teacher, several students could be awarded "computer operator licenses" following proper instruction. A class list may be posted in the computer centre, so that each student can advise the next student that it is his/her turn. If the student has a problem with a program, he/she should get assistance from a "licensed" operator.

Some schools with only one microcomputer may opt to have the microcomputer in a permanent location such as the resource centre. In this case, a certain time/day may be assigned to a particular class. It is advantageous to have older student proctors, aides or volunteers available at the microcomputer site to give necessary assistance.

Some students may set up "travelling computers." In this use, a portable computer stand on wheels may be purchased or made. Just as older students are trained to move a film projector, a similar system could be set up for the use of the microcomputer. Students involved in the moving must be carefully instructed and trained.

The Computer as a Tool to Create Graphics

Suggested graphic-related activities include:

* The teacher should point out the presence and use of graphics in the educational courseware used by the students. Perhaps a familiar piece of courseware which contains graphics (for example, Hurkle by MECC) could be examined in the format of a group discussion. The students would look for the graphic displays and discuss with the teacher what they observe. The teacher might draw the students' attention to such graphic characteristics as: colour, movement, size, design, or any other points of interest.

* After the students have discussed what computer graphics are and how they are used, the teacher and students could bring in some examples of where computer graphics are used in the community (posters, sports score boards, television, movies, "junk mail", magazines, etc.). Once the students are aware of the presence of computer graphics around them, they can begin a list of places where they find computer graphics. In addition, the students might make a collection of items they have found that contain computer graphics and display these in the classroom.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

* Introduce the students to commercially available graphics creation courseware. Allow students to experiment with this courseware in order to produce their own graphics using the microcomputer.

  Examples include:

  . The Friendly Computer (Pictures), MECC
  . Delta Drawing, Spinnaker
  . Facemaker, Spinnaker

* If a printer is available, the pictures created with The Friendly Computer's "Picture" program could be printed out and bound to make a booklet. Alternatively, students could write stories about their pictures to create a classroom story book.

* Level 2 and 3 students could be given the opportunity to create their own graphics using large grid graph paper (20 by 25 squares) to simulate a video display screen. Such drawings could be collected and displayed on a bulletin board or collated to form a class graphics booklet.

IV-1-1
Ma/Teacher
Utility

Level 1 students could be provided with a more concrete graphics creation activity. Students could be given one inch squares of paper on which to create a design. As an advanced activity, a large piece of one inch grid paper could be used in place of the blank sheet. The students then could create designs by placing coloured one inch blocks (if available) or coloured paper squares on the grid.

* The teacher with access to a computer graphics tablet such as the Koala Pad (Apple, C-64) or the Power Pad (Apple) could provide an opportunity for the students to create freehand graphics on the computer screen using the computer graphics tablet as a sketch pad. Such drawings can be saved on a diskette to create a class computer-illustrated book.

The Computer as a Tool for Simulation

Simulation courseware presents a computerized model of a real-life situation. While most concepts are best internalized by students when they are able to experience them first hand, there may be some situations which are too difficult, expensive, dangerous or time-consuming for the classroom setting.

Simple simulation courseware at the primary level is available for most models of microcomputers.

Suggested simulation activities include:

* The teacher could use a simple modelling simulation program such as "ODELL WOODS," "ODELL LAKE," or "SELL APPLES," in order to show how a computer can help people to make and to test a model, an hypothesis, or a conclusion.

* Teachers without access to a piece of simulation software could make use of "Choose Your Own Adventure" books. The story is read by the teacher and decisions affecting the outcome of the story are made by the students at the branching points in the book.

* The teacher could use an adventure simulation such as "OREGON TRAIL," "JENNY OF THE PRAIRIE," or FUR TRADER" in order to have the students make decisions that will affect the "survival" of the group members engaged in the simulation.

The Computer as a Tool for the Creation of Speech, Sound, or Music

The teacher could purchase or borrow, for classroom demonstration and use, a simple learning aid which has speech synthesizing capability (for example, Speak-and-Spell, Speak-and-Read, etc.).

The teacher could point out and demonstrate the presence and use of computer-generated music and/or sound in the educational courseware which students have already used.

Activity suggestions include:

* The teacher could lead a discussion with regard to where computer-generated speech, sound and/or music is found. Some examples of relevance to students at this level include television (K.I.T.T. on Knight Rider), home video games, pop recording groups, etc. The difference between human-produced sound and computer-generated sound may not be obvious to the students unless pointed out by the teacher.

* Students may enjoy moving to computer-generated music as part of a physical education or fitness class. For example, mimic the movement of a robot.

The Computer as a Tool for Word Processing (Level 3)

Some students have difficulty producing a final written copy which meets with expectations. Such students likely would be motivated by using word processing as a tool to produce good looking written work.

* If the teacher can obtain access to a simple word-processing program such as Bank St. Writer or The Magic State (Apple, C-64), Storywriter (PET), PETWORDS (PET, C-64), or TRS-WORDS (TRS-80 Model III/IV), then students could be encouraged to write their own short story independently using the word processor. If there are insufficient numbers of computers to allow each student to work independently a teacher aide/volunteer could type the first draft of each student's story using the word-processor to produce a draft copy. After consulting with the teacher and revising the draft copy, each student could make the required revisions or changes at the word-processor with assistance from the aide/volunteer.

* The students and teacher could visit the school secretary to observe how office work is carried out using a microcomputer. Students could dictate a short story to the secretary who would type it into the word processor and obtain a printout for each student in the class. This would demonstrate the ease of making multiple copies with a word processor. Students should read the story and following class discussion revise the story by adding, deleting, correcting or otherwise changing the original. The secretary could make these changes and print a final copy in the presence of the students. This should demonstrate some capabilities of the word processor.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

2. to act as a "human turtle" which physically models a Logo turtle's movement;
   (Level K-Introduction)
   (Level 1-Expansion)
   (Level 2-Expansion)
   (Level 3-Expansion)

Logo is a computer programming language as well as a creative learning environment through which students can experience discovery-based learning.

Logo software is available only for certain microcomputers so the teacher is urged to check on the availability of Logo for the microcomputer(s) in the school.

To assist in developing an understanding of how the Logo "screen turtle" moves, students should be given many opportunities, at all levels, to physically model turtle movements by acting as a "human turtle." Students should be instructed as "human turtles" to move and turn using the commands of the Logo version available in the school. The commands should be appropriate for the level of instruction. If students are using the "human turtle" as a planning tool they should be encouraged to verbalize their movements and turns using appropriate Logo commands.

When engaging in "human turtle" activities in which the "turtle" follows a student's commands but does not produce the desired result, the student should "debug" the plan, revise it, and then try again.

The teacher should develop a strategy for talking about mistakes or "bugs". For example, try to avoid using statements such as "That is wrong" and instead use statements like "How can this be improved?", "I wonder if your solution will work?" or "Part of your solution is great!"

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

Level K

As a lead up to "robot turtle" manipulation in Objective 3 of this unit, students should be given experience responding to directional arrows as the "robot turtle" would. This "human turtle" activity should aid the student in determining how the "robot turtle" will respond to commands.

IV-2-1
Logo/
Teacher
Utility
IV-2-2
Logo

Level 1

As an introduction to Single Keystroke Logo the teacher may introduce the commands as suggested in Activity IV-5-1. The teacher could act as a "human turtle" with students giving the commands for movement to a specific destination within the classroom. The teacher may wish to have a student record the commands (FFRF) on the blackboard. Then, students may refer back to the written record as the commands that the "screen turtle" will understand in Objective 5 of this unit.

IV-2-3
Logo
IV-2-4
Logo

* Star Game. Teachers could prepare a number of stars and place them on the floor in a relatively straight path. One student then can be chosen to walk the star path ("turtle astronaut" wearing a turtle hat), another can give the commands to move the "turtle astronaut" from star to star. Using Single Keystroke Logo commands the "turtle astronaut" may be instructed F F F L F to get to the first star and then continue in this way until the end of the star path is reached.

Level 2

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It is recommended that Level 2 students begin using a Logo language which requires the input of numbers after the FORWARD, BACK,

IV-2-5
Logo

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LEFT and RIGHT commands. When first introducing Logo the teacher would act as a "human turtle" unable to move until students supply the input for "how much" or "how far."

* Hide and Seek. Choose one student to hide an article of food (orange, apple) somewhere in the classroom. Choose another student who will seek the food following Logo commands given by the student who hid the food. Encourage the use of appropriate Logo commands using FORWARD or BACK (starting number of steps) and RIGHT or LEFT (stating turning angle).

Level 3

* Logo-like Blind Man's Bluff. One player is chosen to the "turtle" and is blindfolded. Another person is chosen to be the "programmer." The "programmer" turns the "turtle" around three times while the other students find a spot on which to "freeze." The "programmer" picks one player and then instructs the "turtle" using turtle commands (RIGHT 80, FORWARD 7)to turn and walk toward that player. The "turtle" reaches out and tries to touch and to identify the player. If the "turtle" identifies the player, the "programmer" commands the "turtle" to go forward again towards another player. The first player not identified becomes the new "turtle." The old "turtle" becomes the "programmer." IV-2-6 Logo/ Teacher Utility

* Astronaut, Spaceship. Have students create some large stars and planets using construction paper or other materials. Place them on the floor as an imaginary "solar system." Choose one student to take the role of the "astronaut" and another student to take that of the "spaceship." The "astronaut" is to stand somewhere within the "solar system" and to

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
	direct the "spaceship" to that location. The "astronaut" should use appropriate Logo commands. The "spaceship" now becomes the "astronaut" and a new "spaceship" is selected. Rearrange the "solar system" or have the "astronaut" choose a different place to stand.	
3. to manipulate a "robot turtle"; (Level K-Introduction) (Level 2-Expansion)	Level K Once students become familiar with "human turtle"movement they may begin to explore the movement of a "robot turtle." Big Trak, Tasman Turtle or Turtle Tot are suitable robotic devices.	IV-3-1 Logo
	Level 2 Robots come in many sizes and shapes, with a variety of attributes. To further the student's understanding of the fact that there are differences and similarities among robots, both real and fictional, the teacher can use Activity IV-3-2.	IV-3-2 La/Ma/Sc
	* The teacher could lead and encourage discussion concerning the names, appearances, and capabilities of robots which are familiar to the students. For example, robots can be found in the movies Star Wars, The Black Hole, The Computer That Wore Tennis Shoes, and Flash Gordon. Many current children's television shows such as Battlestar Galactica (robot dog K-9) and Knight Rider (K.I.T.T.) portray robots. Teachers with access to videotape recorders could show a movie clip which illustrates one of these fictional robots or a real robot.	

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
	In the discussion which follows the viewing of the movie or which centres on experiences the students have had with robots, it is important to distinguish between what is real and what is probable. Students could discuss how the creation and use of robots may affect their lifestyle.	
	* The teacher could assist Level 2 students in researching books about robots and in making a display of those books. The students could be encouraged to use their research material to produce their own class book about robots. In addition, students may wish to create their own individual stories about fictional robots or to build their own life-size fictional robot using large cardboard boxes.	IV-3-3 LA/Sc
	* Using the designs on pages 1 to 6 of Activity IV-3-4, the teacher could reproduce, cut out and collate individual robot-shaped booklets. For durability, the cover should be on manilla. Before doing each outlined activity discuss the concept(s) with the students. The students can then complete their own booklets.	IV-3-4 LA/Sc/SS IV-3-5 Logo
4. to manipulate a Logo "concrete turtle" device; (Level 1-Introduction) (Level 3-Expansion)	Level 1 Once students have gained experience as a "human turtle" using the commands from Single Keystroke Logo (refer to Unit IV, Objective 2 and Unit IV, Objective 5) they should be given the opportunity to manipulate a "concrete turtle" using these same commands.	IV-4-1 Sc/Logo
	Level 3 As an expansion activity in Level 3 for manipulating a "concrete turtle", the student could be introduced to "turtle tiles." These "turtle tiles" are found in David Thornburg's Every Kid's First Book of Robots and Computers, Greensboro: Compute Books!, 1982.	

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
5. to manipulate a Logo "screen turtle" using Single Keystroke Logo; (Level 1-Introduction)	Single Keystroke Logo allows students to press a single key which the "screen turtle" responds to by moving, turning, executing a pen movement or drawing a pre-programmed shape. This frees the student from the need to have more developed keyboarding skills and the need to remember the syntax required to use the Logo language.	
	Once students have completed Activities IV-2-4 and IV-4-1 they should have internalized "human turtle" and "concrete turtle" movements and now should be able to transfer these experiences to the "screen turtle" using a version of Single Keystroke Logo.	IV-5-1 Logo/ Teacher Utility
	After students have been introduced to the commands available, they should be encouraged to use these to investigate and to create their own designs.	
	At the present time there are a number of versions of Single Keystroke Logo available commercially. If such a version is not found in the school, the teacher may wish to create their own using Activity IV-5-2.	

Name of Single Keystroke Logo	Version of Logo Needed to Use Single Keystroke Logo	Producer
Doodle Logo	Radio Shack Colour Logo	Radio Shack
Doodling Turtles	Apple Turtles	Educational Technology Program (Manitoba Education)

IV-5-2 Logo/ Teacher Utility

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

Name of Single Keystroke Logo	Version of Logo Needed to Use Single Keystroke Logo	Producer
EZ Logo	Apple Logo	Minnesota Educational Computing Corporation (MECC)
Instant Logo	C-64 Logo	Commodore
One Key Logo (OKL)	Terrapin Logo	Chuck Friesen Lincoln Public Schools Box 82889 Lincoln Nebraska 68501

6. to experiment with a Logo "screen turtle" in immediate mode;
(Level 2-Introduction)
(Level 3-Expansion)

Using the version of Logo available, the teacher should introduce students to the commands needed to manipulate the "screen turtle" in immediate mode. Activities IV-2-5 and IV-3-5 allow students to learn these commands by acting as a "human turtle" and through manipulating a "robot turtle." When students are ready to experiment with the "screen turtle" the teacher may prepare transparencies of mazes with various turning angles (90°, 45°, 30°, 60°) to place over the monitor screen. Students move the "screen turtle" through the maze estimating distance and turning angle.

IV-6-1
Ma/Logo/
Teacher
Utility

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
	Level 2 Students should be introduced to the following Logo commands: FORWARD, BACK, RIGHT, LEFT, HOME, CLEARSCREEN, PENERASE, PENUP and PENDOWN. Level 3 Teachers may wish to introduce additional commands such as HIDETURTLE, SHOWTURTLE, PENCOLOR and BACKGROUNDCOLOR.	
7. to devise, record, test, and revise a plan for the creation of a design using Logo in immediate mode. (Level 3-Introduction)	To achieve this objective the teacher should encourage the student to act as a "human turtle" (Unit IV, Objective 2) or to manipulate a "concrete turtle" (Unit IV, Objective 4) and to experiment with a "screen turtle" (Unit IV, Objective 6) before beginning to create their own simple design. The student should be encouraged to use a "TOP-DOWN" approach to problem-solving. This approach is a step-by-step breakdown of the problem into logical components which can be solved separately and then put together to form the overall solution to the original problem. A more formal treatment of TOP-DOWN problem-solving begins in grade 4 of the Computer Awareness Program.	IV-7-1 Logo

V. COMPUTERS IN OUR LIVES 20%

This topic is intended to promote student awareness of computer technology in the home, school, and community. Emphasis is placed on integration with the Social Studies and Language Arts curricula. It is not necessary to have access to a microcomputer in the classroom in order to achieve the objectives of this unit.

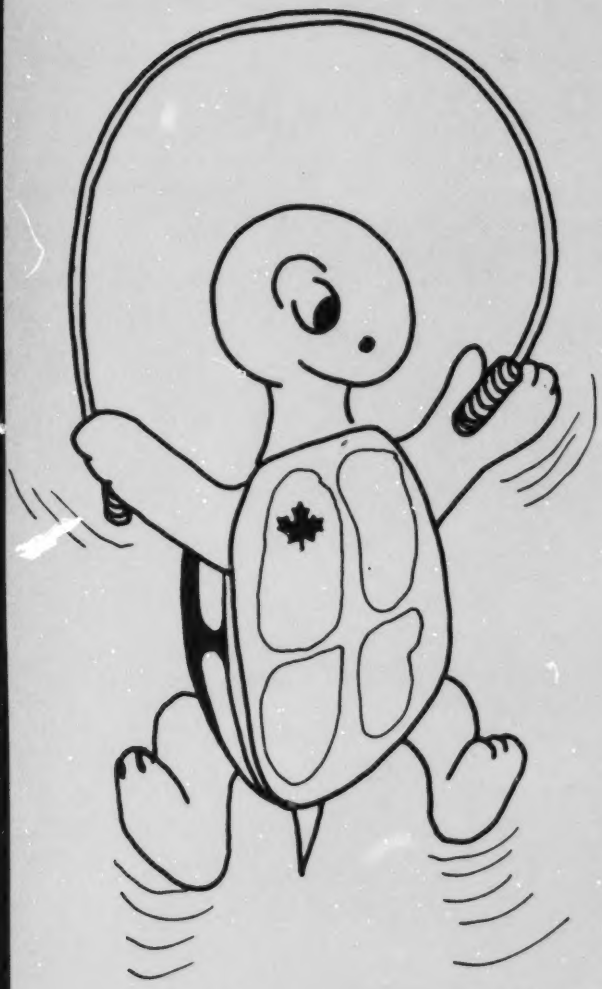
OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
The student should be able:		
1. to recognize common devices which use microchips in the home, in the school, and in the community; (Level 2-Introduction) (Level 3-Expansion)	Microchips or integrated circuits are the primary components of a computer and are found increasingly in other common devices such as automobiles, microwave ovens, watches, video cassette recorders and televisions. The teacher is encouraged to correlate activities for this objective with appropriate topics in the Social Studies curriculum. * Have the students survey their homes for devices which contain microchips. Examples of devices which contain microchips include computers, calculators, computer games, Dataman, Little Professor, Simon, Speak and Spell, Speak and Read, Big Trak, musical instruments, microwave ovens, automobiles, and digital clocks. Students could graph, make wall charts or prepare scrapbooks of their findings.	V-1-1 LA/SS/ Teacher Utility
2. to recognize uses and users of computers or computer-supported applications in the community; (Level 2-Introduction) (Level 3-Expansion)	* Prepare a chart of family occupations which make use of computers. * The teacher could employ any of the following techniques to help students recognize computer applications within a local community: field trips, video tape viewing, bulletin board construction, discussions, library research, collection of newspaper and magazine articles, or a "scavenger hunt" of computerized output (for example, Hydro bills, grocery tapes, "personalized" junk mail, etc.).	

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
	* Divide the class into three groups titled: "In the School," "In the Home," and "In the Community." Each group could make a field trip in which they gather information (photographs, sketches or articles) on various devices relating to their topic (home, school, or community) which use integrated circuits. Each group could then make a presentation and share information with the rest of the class.	
	* Put on a play or skit that deals with computers in the home, school, and local community. An example of such a play is found in Activity V-2-1. This play is intended to be performed by the entire class after each student has obtained information on how computers are used by members of their family in the home or in the community. In Act 3, there is a section asking for "INPUT FROM COMPUTER CLASS". At this point, every student stands up and gives a brief report of their own findings about computers. This technique allows all students to participate in the play and to create their own dialogue.	V-2-1 LA/SS
3. to experience the use of computers in recreation. (Level 2-Introduction) (Level 3-Expansion)	The teacher should encourage students to make wise and creative use of their recreation or leisure time as the proportion of their lives spent in leisure activities will likely increase with the introduction of new technologies.	
	* Make a collection of computerized games. Encourage students to bring these games to school and allow students "hands-on" experience with these devices. Games could include: What's That Tune, Dataman, Little Professor, Speak 'n Spell, Simon, television games, etc.	

* Cut out pictures of computerized games from magazines and catalogues for classroom display. Students could categorize them into different types such as music games, memory games, misunderstanding games, board games, speed games, or they can devise their own categories.

* Bring in samples of computerized equipment that allow for the creative use of leisure time. One example is a computerized piano-like keyboard which allows music composition (for example: Portasound by Yamaha, or Music Synthesizer by Realistic). Perhaps a guest who can use and discuss such equipment could make a class presentation.

* Bring in simulation sports games (such as "Olympic Decathlon") or art activity programs (such as the Koala Pad) in which students "play" or "draw" on the screen.



activities

Learning The Keyboard

I-1-1
Levels 1,2,3
LA
P.1 of 6

DIRECTIONS:

Students colour code the important keys on a paper keyboard.

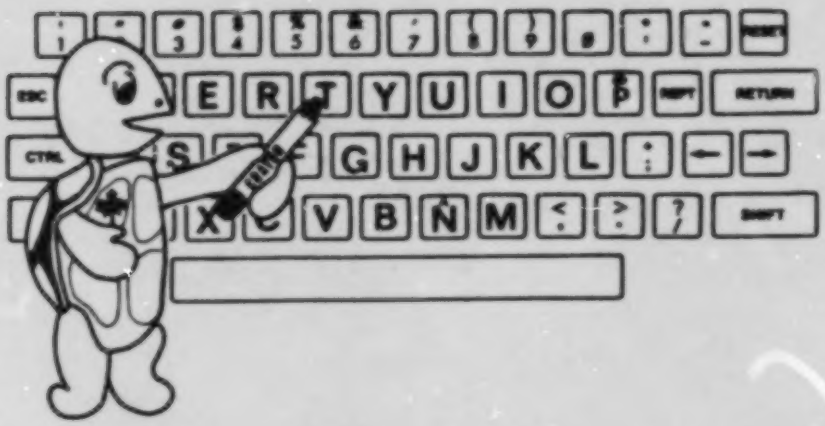
For example: Colour the letters of your name red.

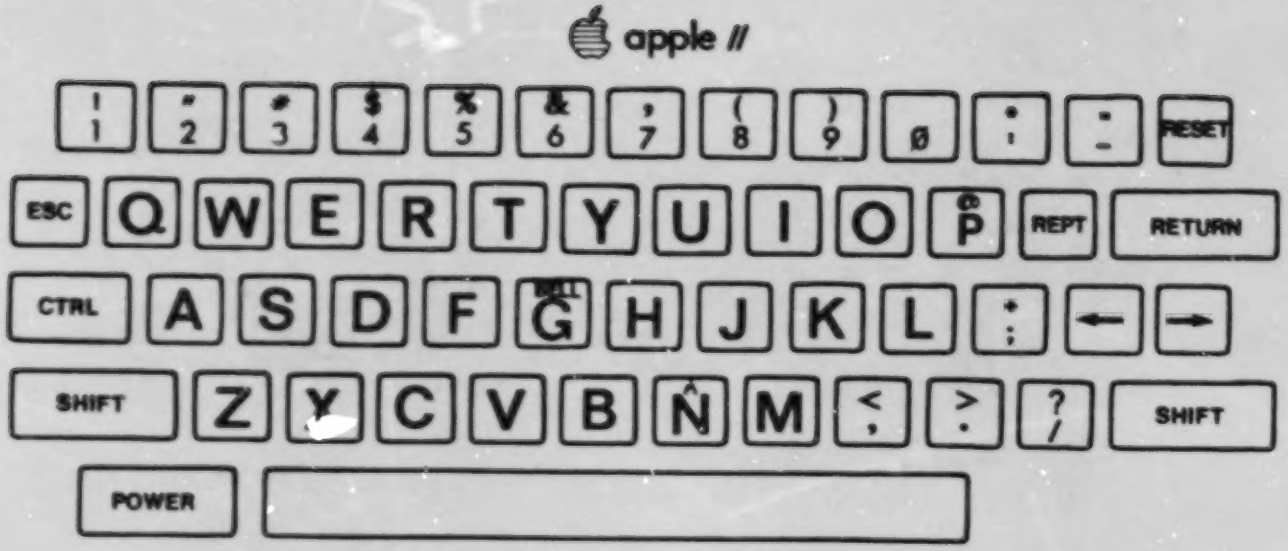
Colour the numbers in your telephone number blue.

Colour the SPACE BAR purple.

Colour the RETURN key green.

79



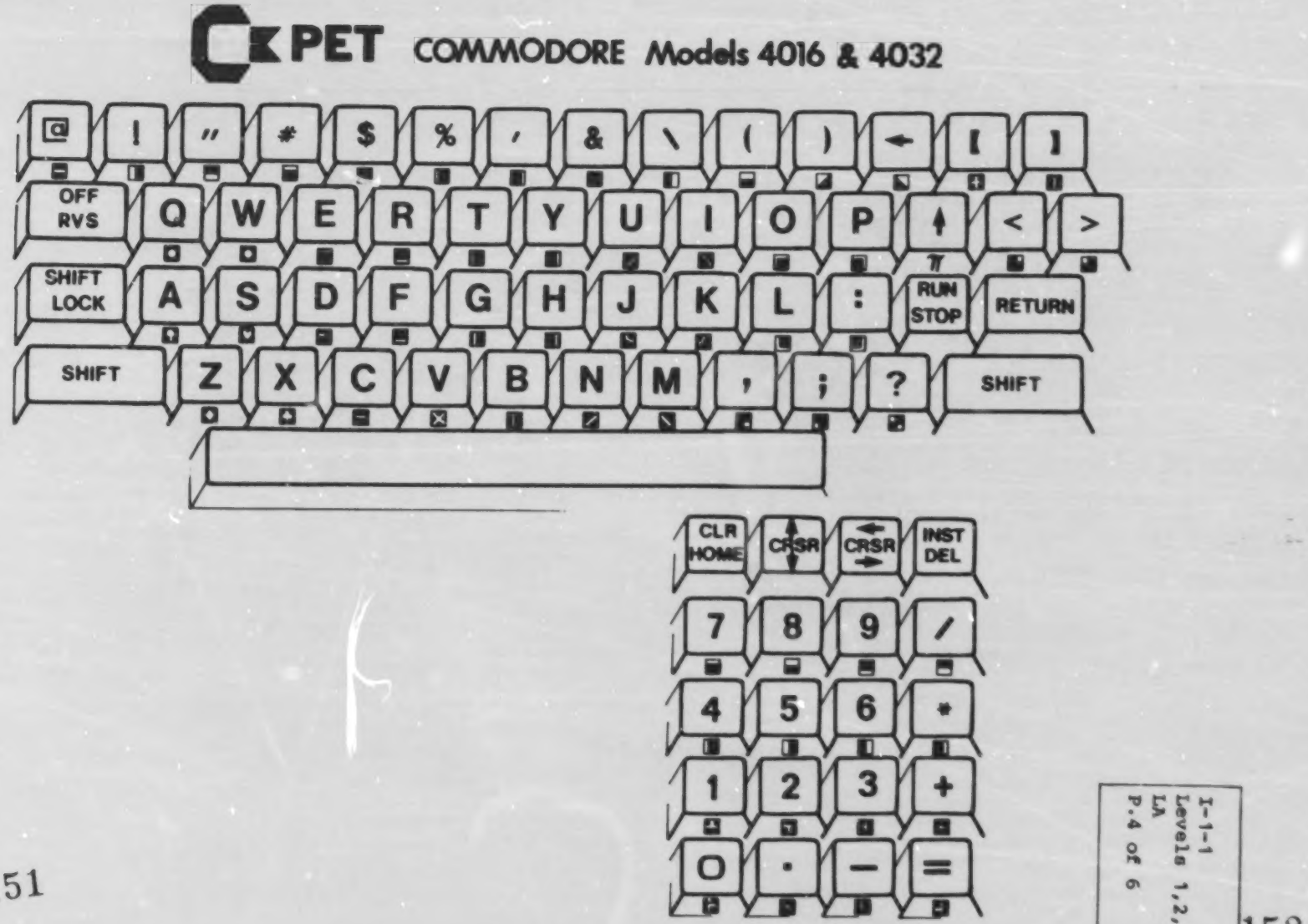


147

I-1-1
Levels 1,2,3
LA
P.2 of 6

148

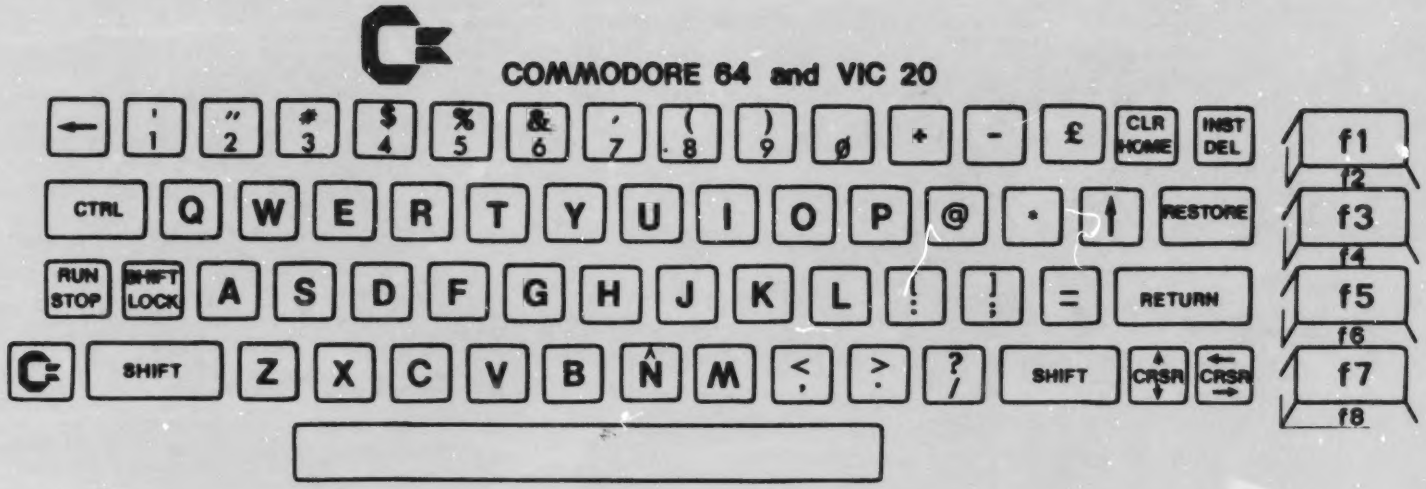
I-1-1
Levels 1,2,3
IA
P.3 of 6


PET COMMODORE Models 4016 & 4032
@ ! " # $ % ' & \ ( ) ← [ ]
OFF RVS
Q W E R T Y U I O P ↑ < >
SHIFT LOCK
A S D F G H J K L : RUN STOP RETURN
SHIFT
Z X C V B N M , ; ? SHIFT
CLR HOME
CRSR
CRSR
INST DEL
7 8 9 /
4 5 6 *
1 2 3 +
0 . − =

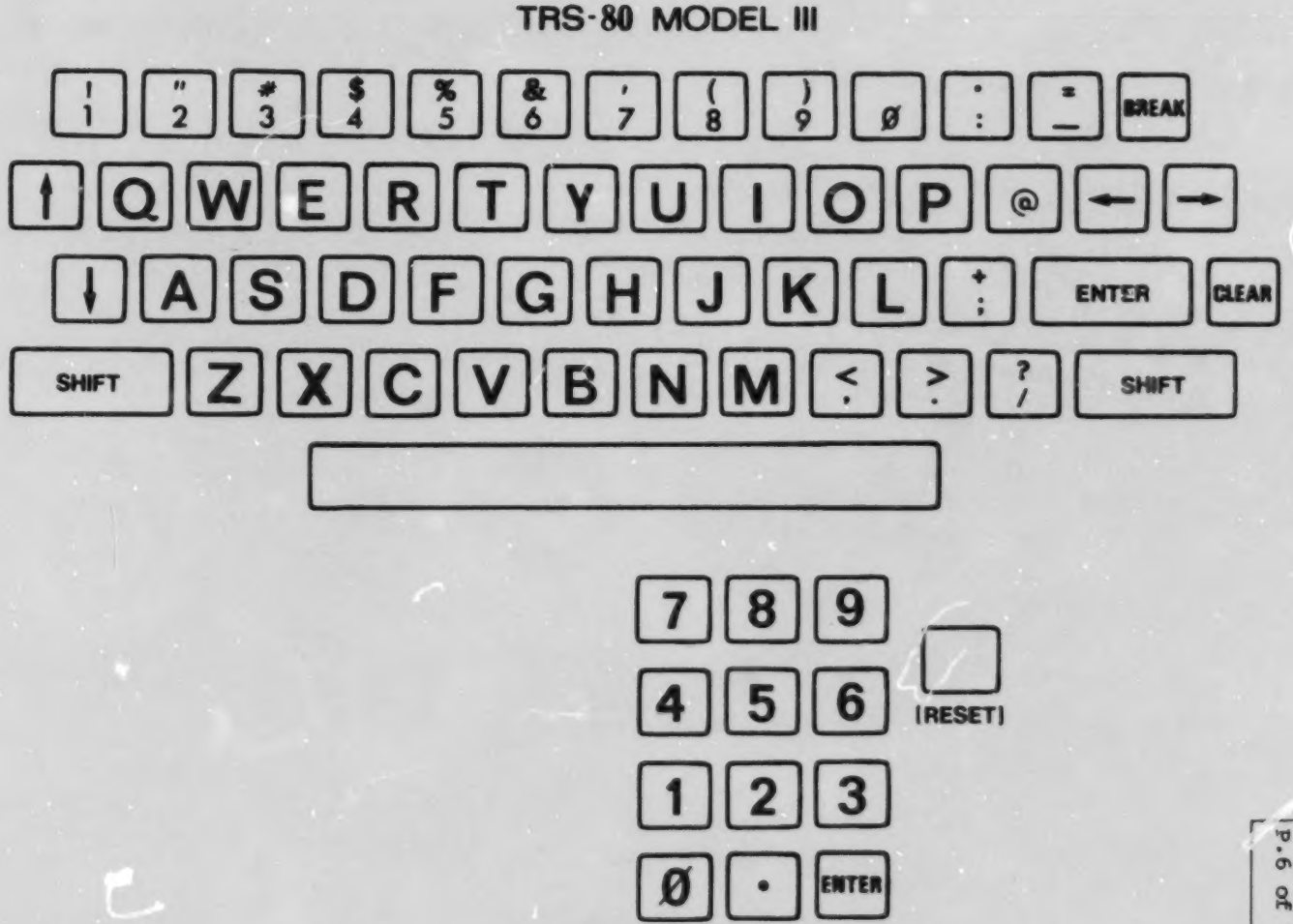
151

I-1-1
Levels 1,2,3
LA
P.4 of 6

152



I-1-1
Levels 1,2,3
LA
P.5 of 6



155

I-1-1
Levels 1,2,3
IA
P.6 of 6

156

Typewriter Keyboard Skills

I-1-2
Level 1
LA/Fine Motor Skills
P.1 of 1

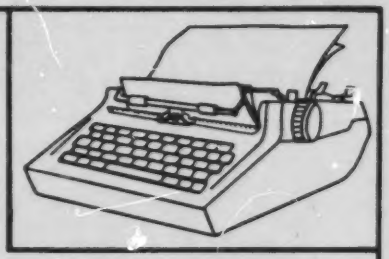
DIRECTIONS:

Reproduce sample cards. Print a different activity on each card. Laminate cards for longer use.

Activity suggestions:

- Type your name.
- Type the numbers from 0 to 9.
- Type the colour words red, blue, and yellow.

Note: It may be necessary to enlarge the card format for young students.



85

Computer Keyboard Skills

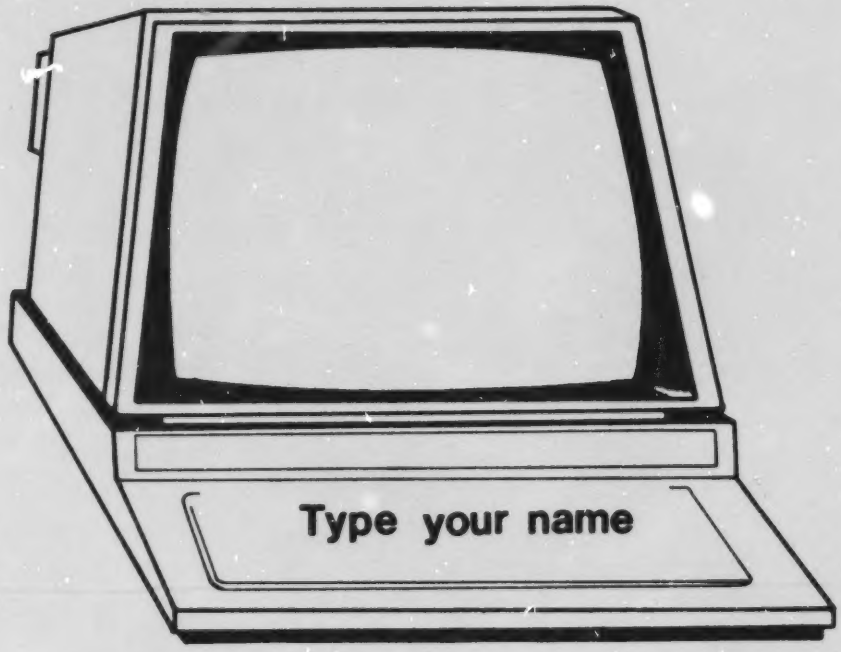
I-1-3
Level 2
LA/Fine Motor Skills
P.1 of 1

DIRECTIONS:

Make individual activity cards using the sample card found in Activity I-1-5. These could be laminted and placed near the computer for students to use in order to gain familiarity with the microcomputer keyboard.

Activity suggestions:

- Type your home address.
- Type your phone number.
- Type the alphabet.



More Computer Keyboard Skills

I-1-4
Level 3
LA/Fine Motor Skills
P.1 of 1

DIRECTIONS:

Make individual activity cards using the sample found in Activity I-1-5. These could be laminated and placed near the computer for students to use in order to gain familiarity with the microcomputer keyboard.

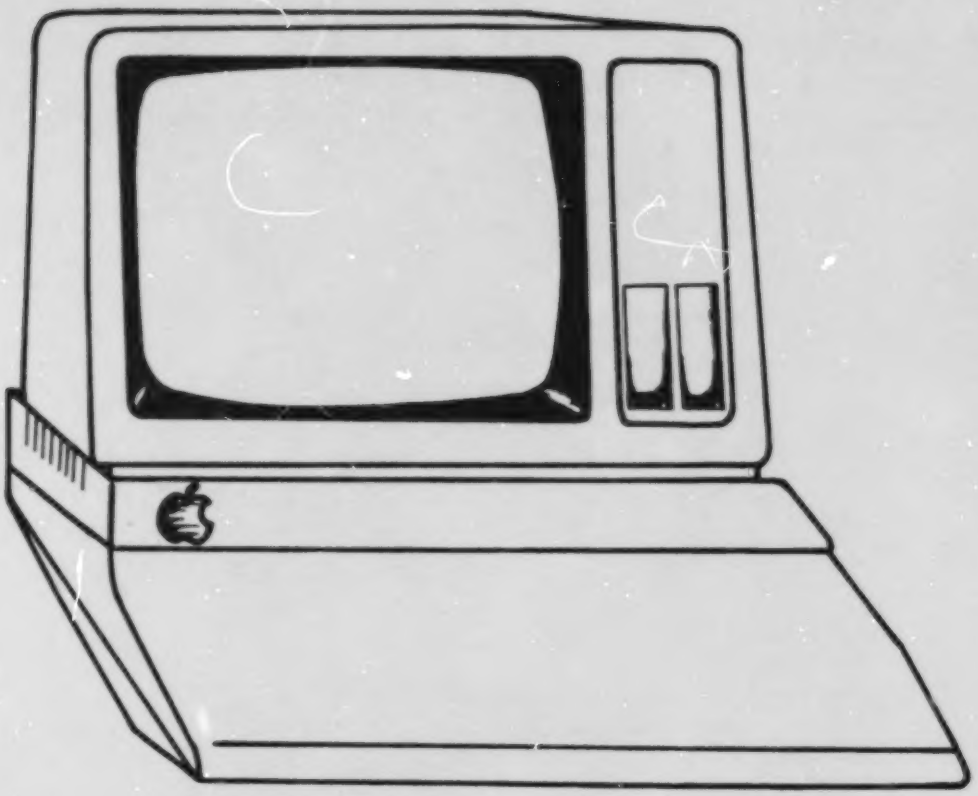
Activity suggestions:

- Type the name of your school.
- Type the name of your teacher.
- Type the names of your favourite colours.
- Count by 2's leaving a space between each numeral.

87

Computer Keyboard
Activity Card

I-1-5
Levels 2,3
Teacher
Utility
P.1 of 1



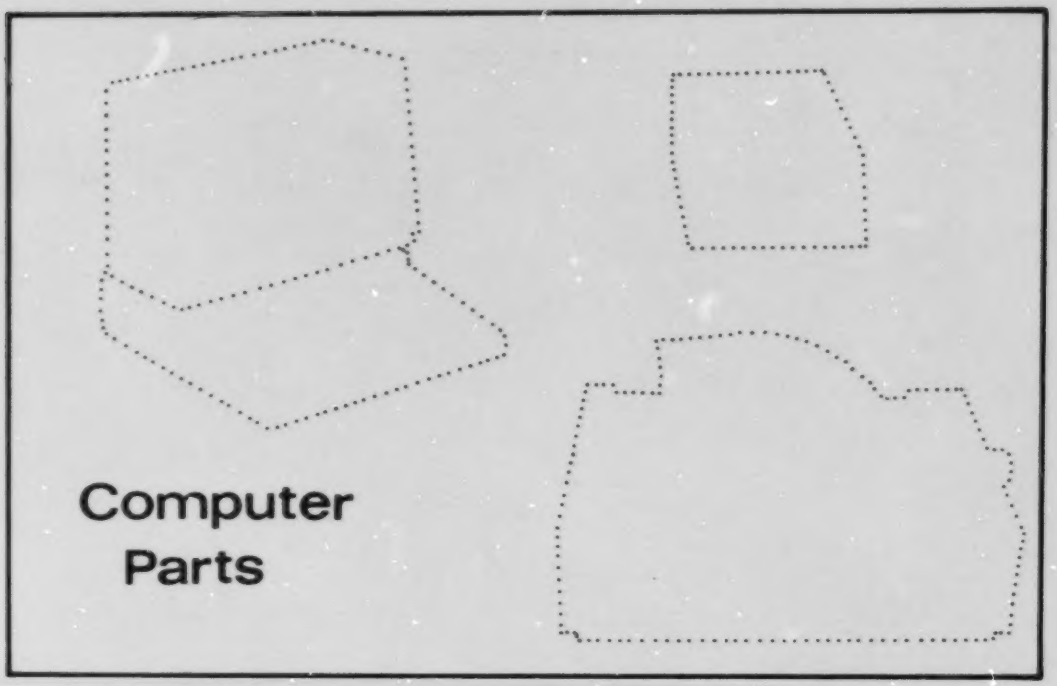
88

Computer Parts

I-2-1
Level 1
LA/Sc/Teacher
Utility
P.1 of 2

DIRECTIONS:

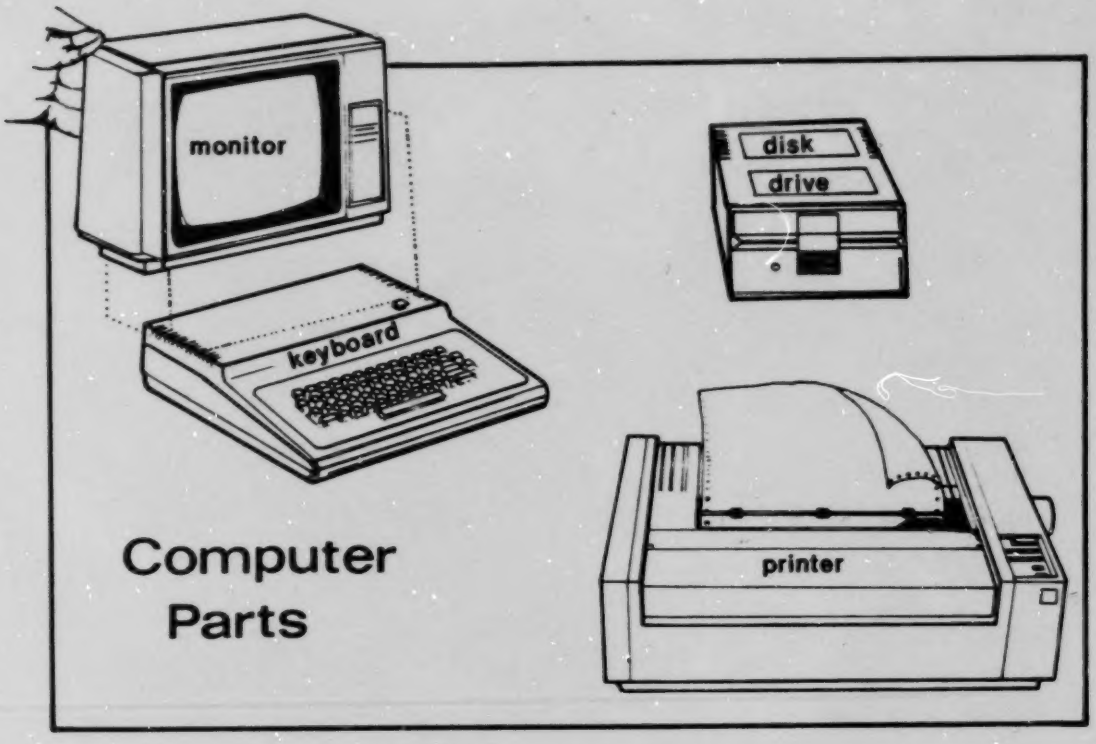
1. Make an outline of your school's microcomputer system on a large sheet of poster board. Enlarge the sample below, modifying it to suit the hardware in your school.



89

2. Cut out pieces for each outlined part. Label and laminate these pieces. Pieces could include disk drive, printer, monitor, keyboard and microcomputer.

3. Have students identify the outlined parts and then stick the correctly identified pieces to the outline on the poster board with masking tape or velcro.

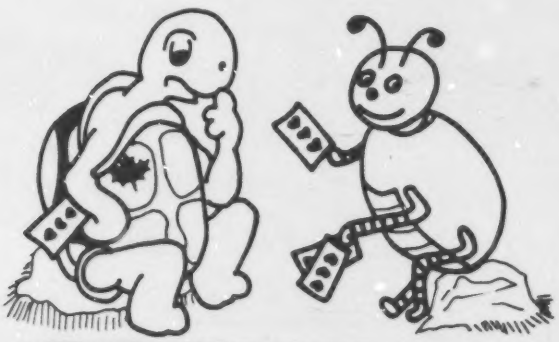


DE-BUG

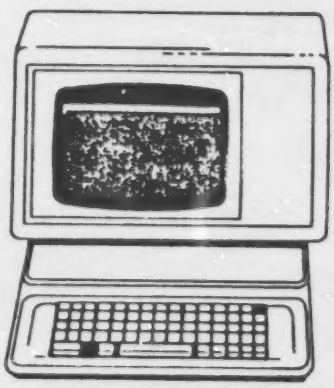
I-2-2
Level 1
LA/Sc/SS
P.1 of 4

DIRECTIONS:

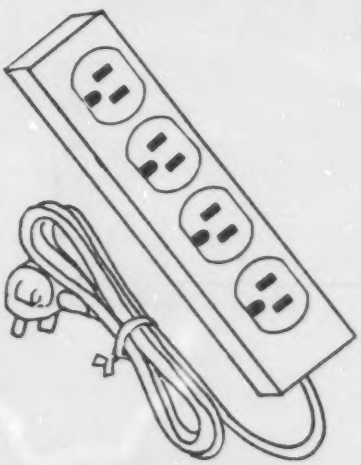
It is suggested that teachers prepare cards for use in the game of De-Bug. The illustrations provided may be glued to larger cards for youn students.



BUG

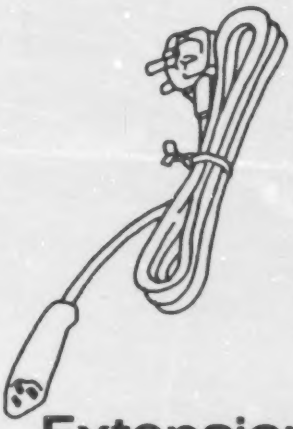


Micro-
computer

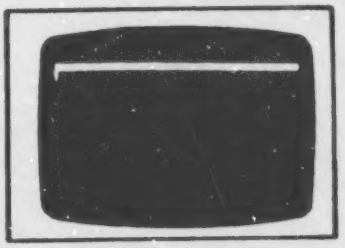


Power Bar

91

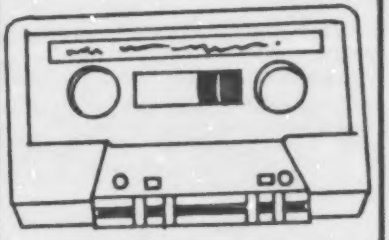


Extension Cord



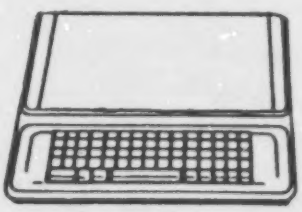
Screen

Diskette



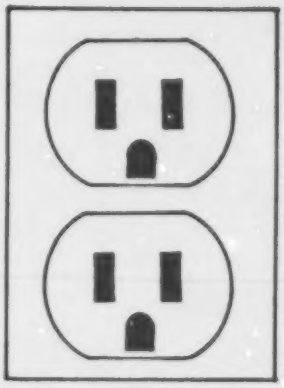
Cassette

92

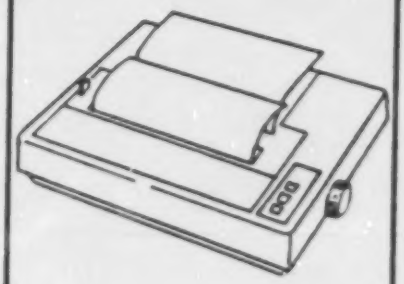


Keyboard

Cursor



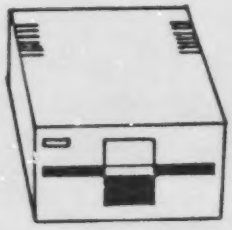
Plug



Printer

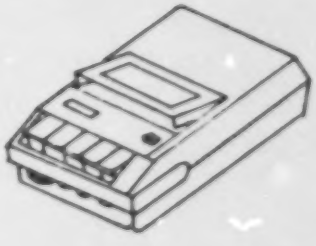
93

Cord

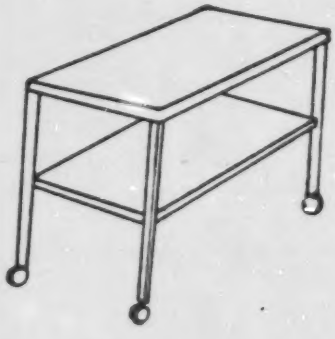


Disk Drive

94



Tape Recorder



Computer Cart

Diskette Care Posters
Level K

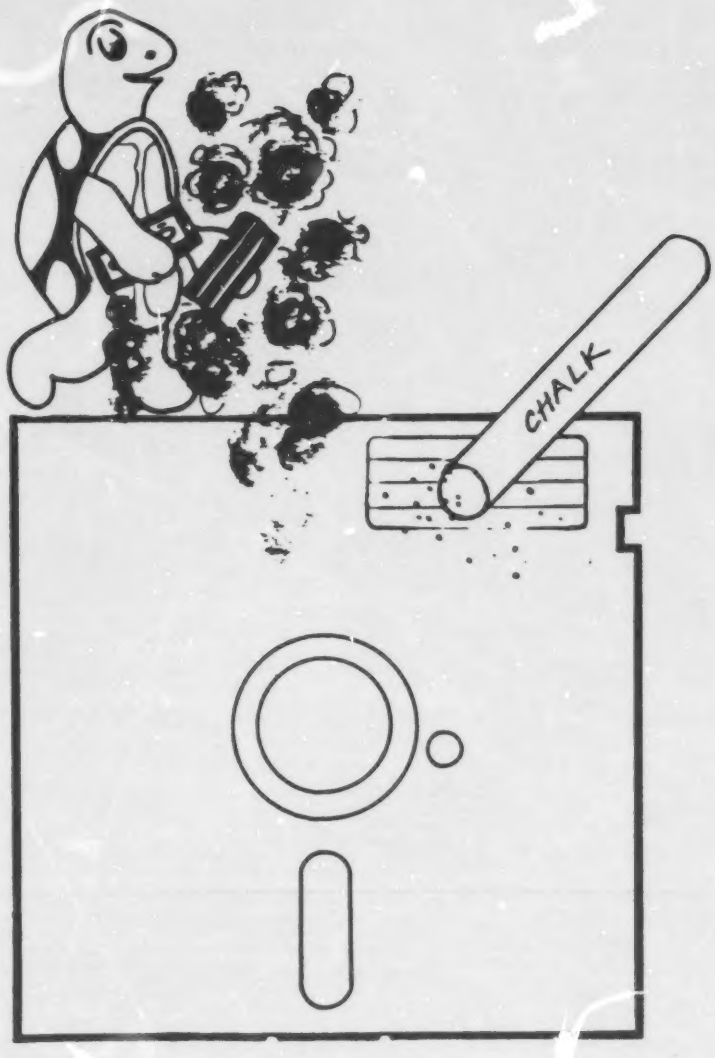
I-2-3
Level K
LA
P.1 of 3

DO NOT BEND

95

I-2-3
Level K
LA
P.2 of 3

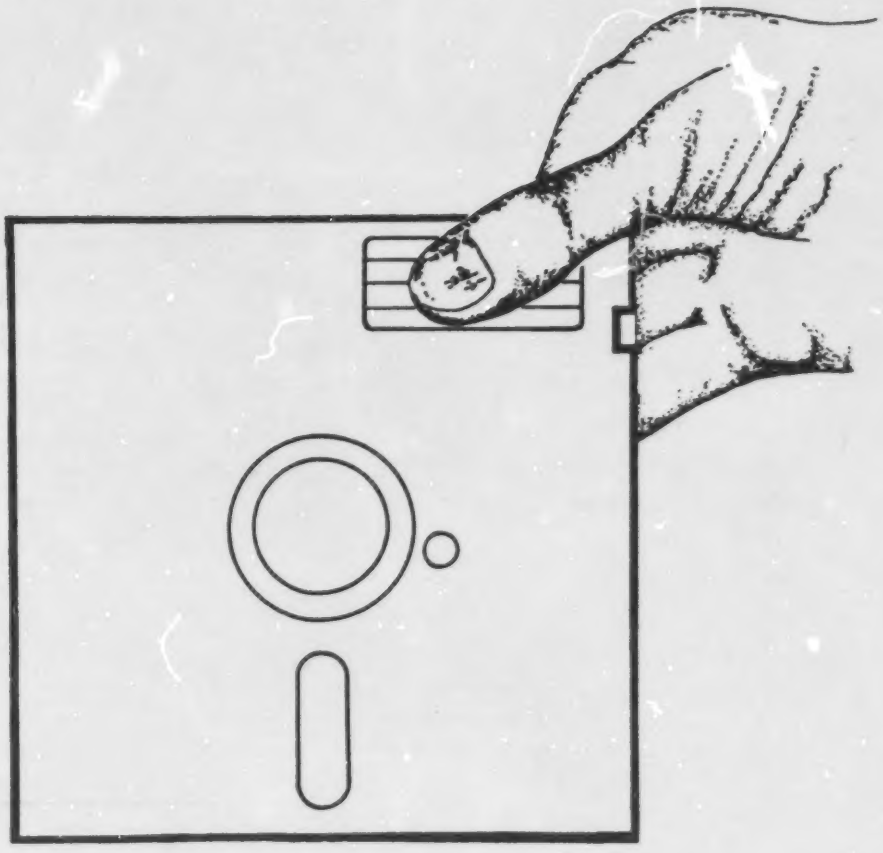
KEEP AWAY FROM CHALK DUST



96

I-2-3
Level K
LA
P.3 of 3

HOLD DISKETTE BY LABEL



97

Diskette Care Posters

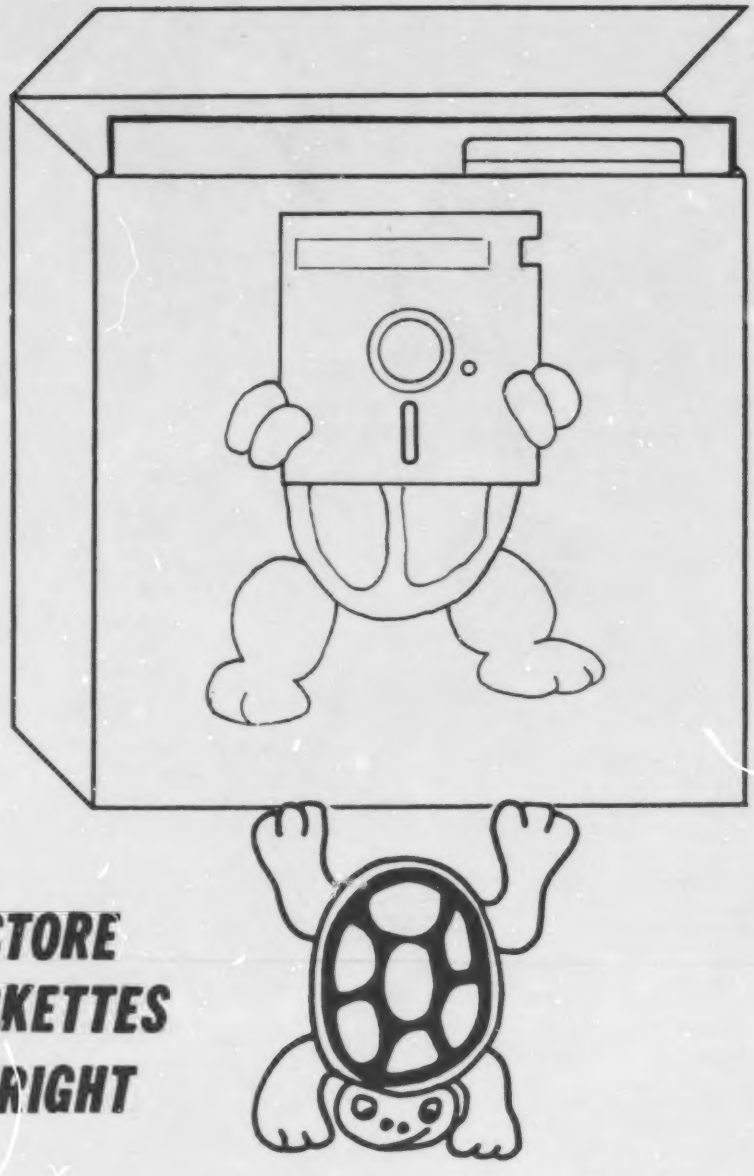
Level 1

I-2-4
Level 1
LA
P.1 of 3

KEEP DISKETTE IN ITS ENVELOPE

98

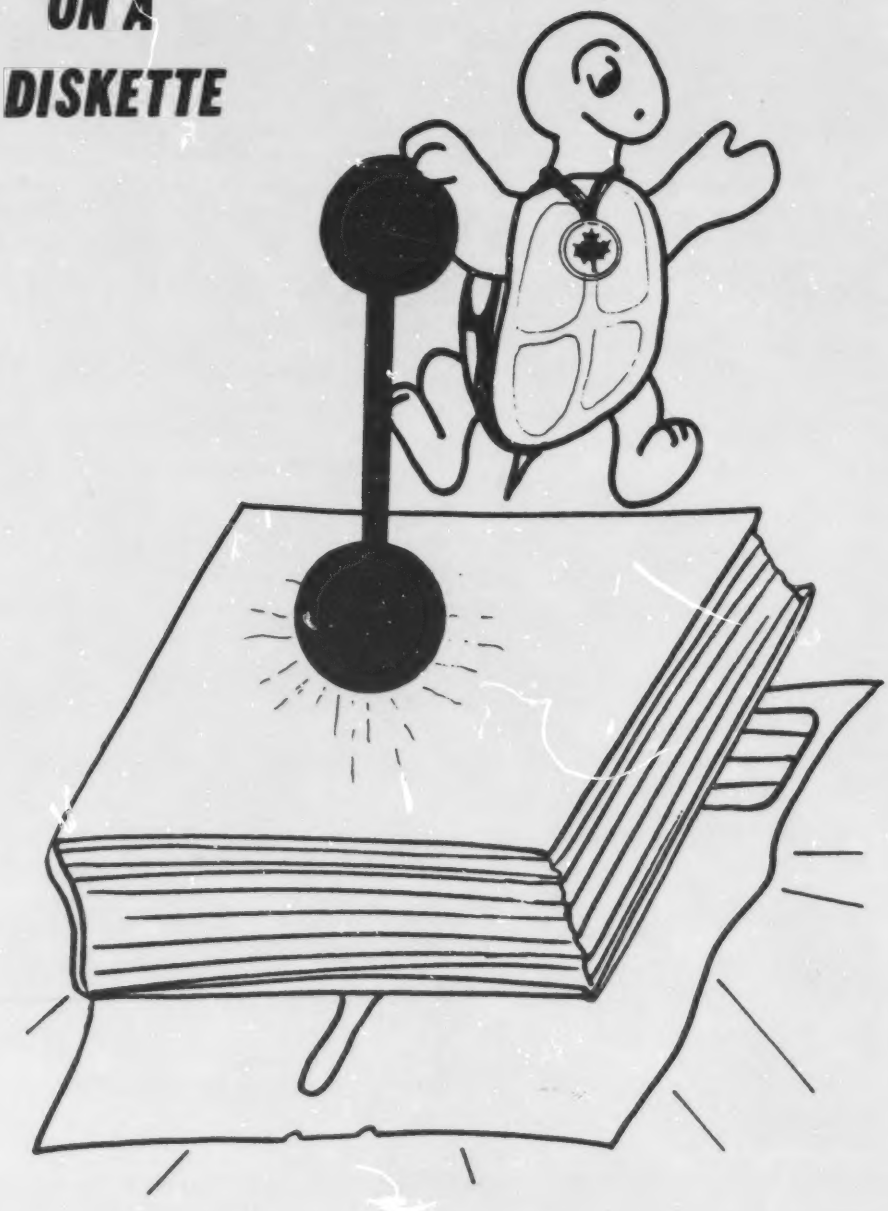
I-2-4
Level 1
LA
P.2 of 3



STORE DISKETTES UPRIGHT

I-2-4
Level 1
LA
P.3 of 3

DO NOT
PUT HEAVY THINGS ON A DISKETTE



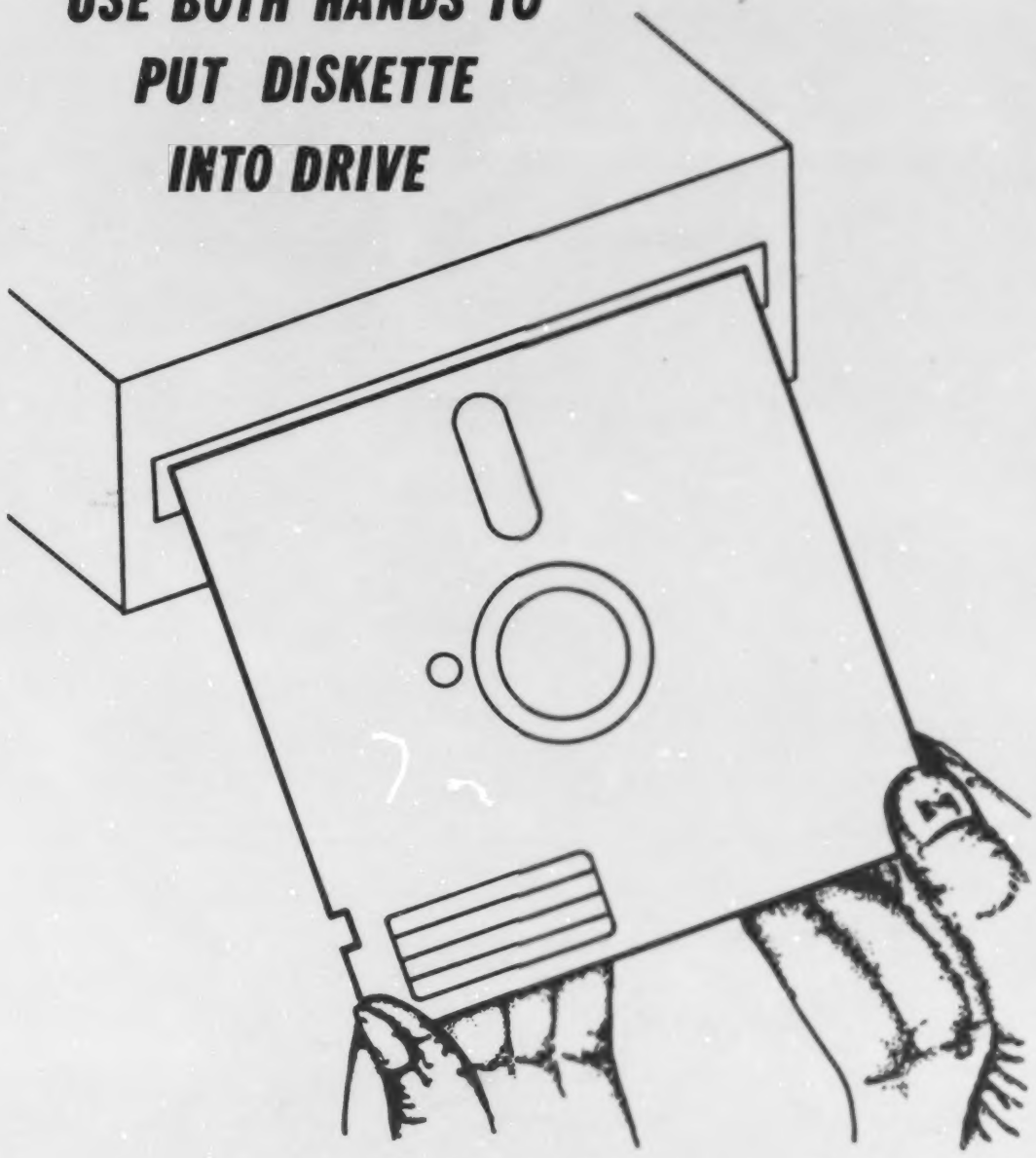
100

Diskette Care Posters

Level 2

I-2-5
Level 2
LA/SS
P.1 of 4

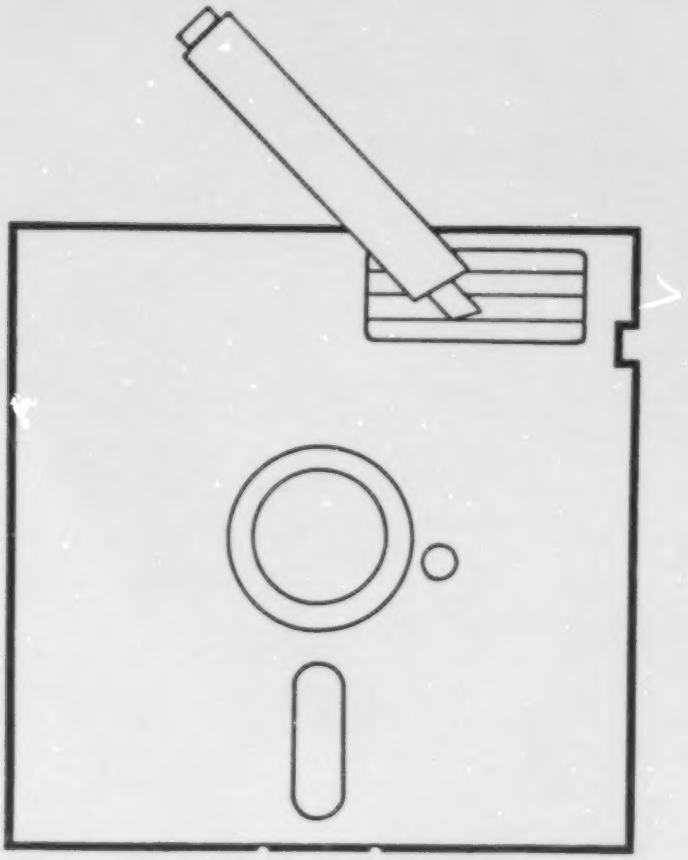
USE BOTH HANDS TO PUT DISKETTE INTO DRIVE



101

WRITE ON A DISKETTE LABEL WITH A FELT MARKER

I-2-5
Level 2
LA/SS
P.2 of 4

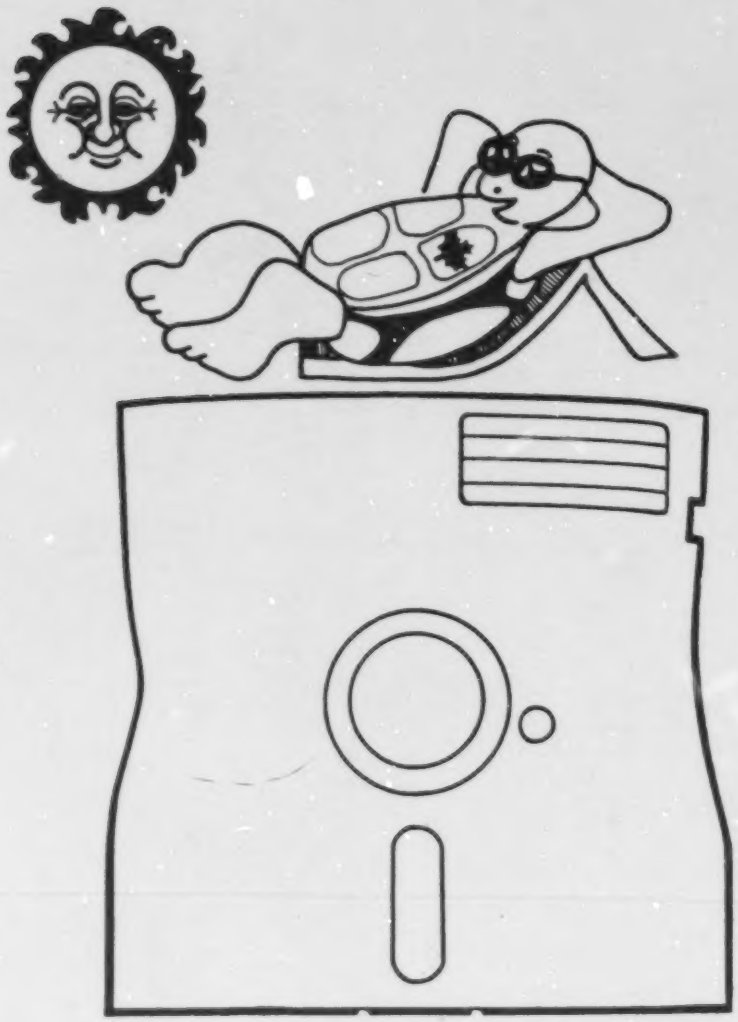


102

I-2-5
Level 2
LA/SS
P.3 of 4

KEEP DISKETTE

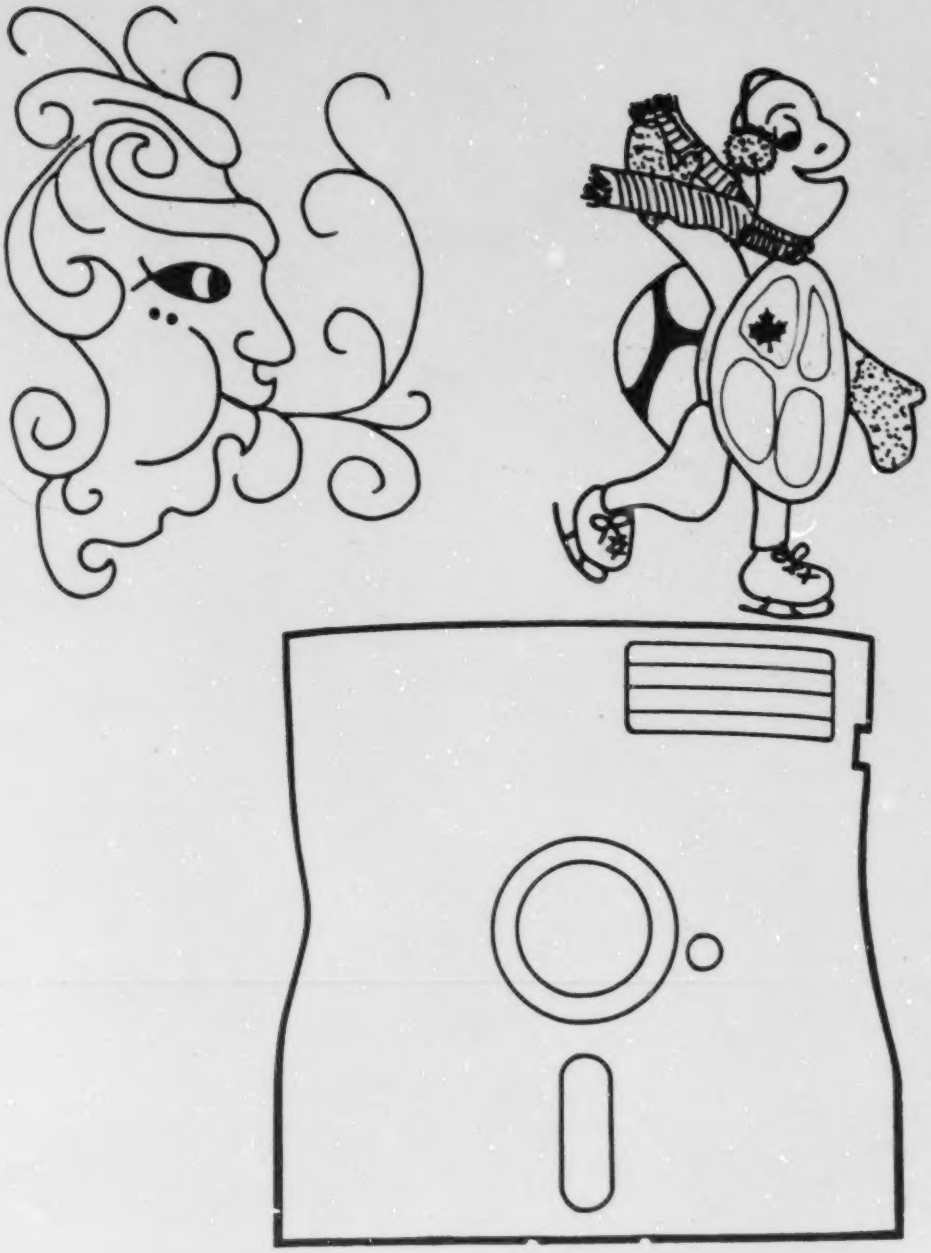
AWAY FROM HEAT



103

AVOID THE COLD

I-2-5
Level 2
LA/SS
P.4 of 4

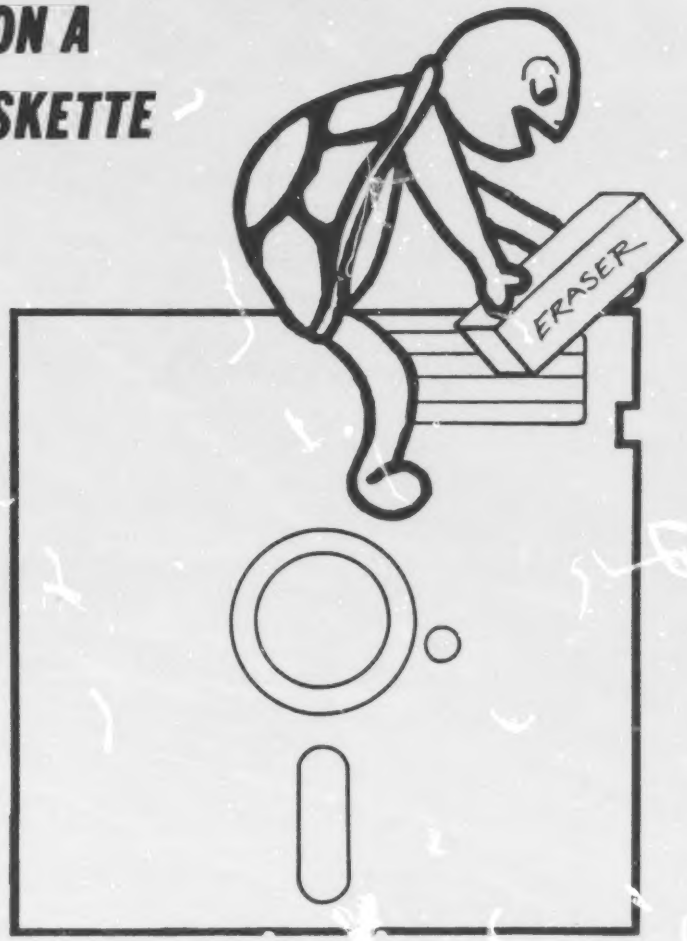


104

Diskette Care Posters
Level 3

I-2-6
Level 3
LA
P.1 of 3

AVOID USING ERASERS ON A DISKETTE

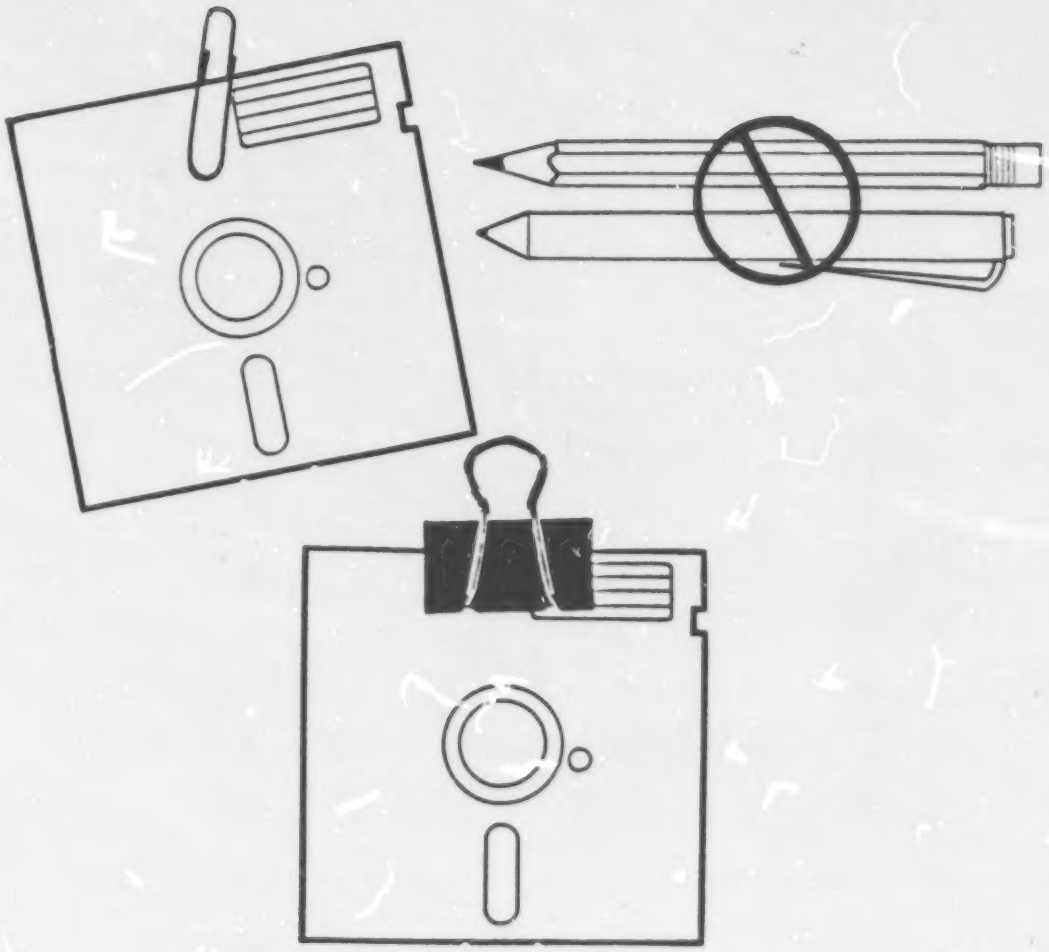


105

I-2-6
Level 3
LA
P.2 of 3

NO

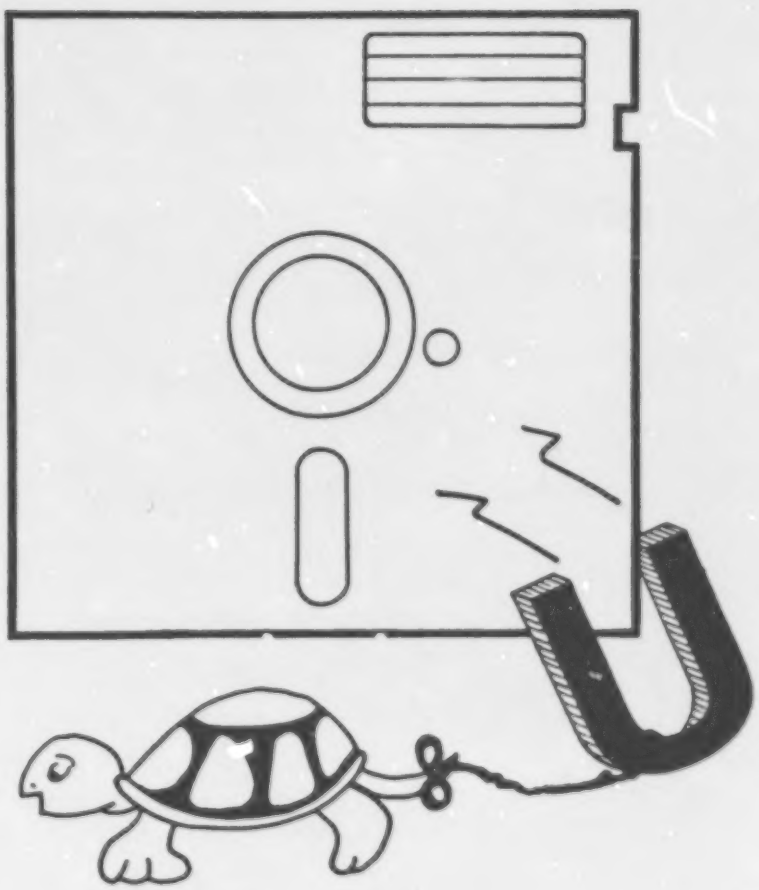
PENCILS, CLIPS, or BALLPOINTS



106

I-2-6
Level 3
LA
P.3 of 3

AVOID MAGNETS



107

Cassette Care

I-2-7
Level 2
LA/SS
P.1 of 1

Store cassettes in cases.
Keep them clean.

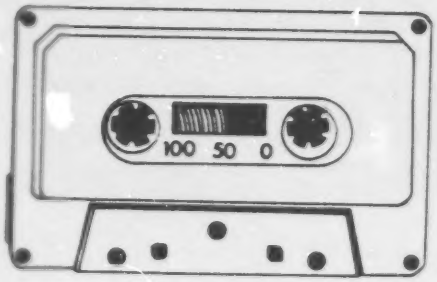
Always rewind cassettes
after use.

Never stop a cassette
during loading.

Do not drop cassettes
on the floor.

Always remove cassette
from tape drive after
loading.

Never touch the cassette
tape surface.



108

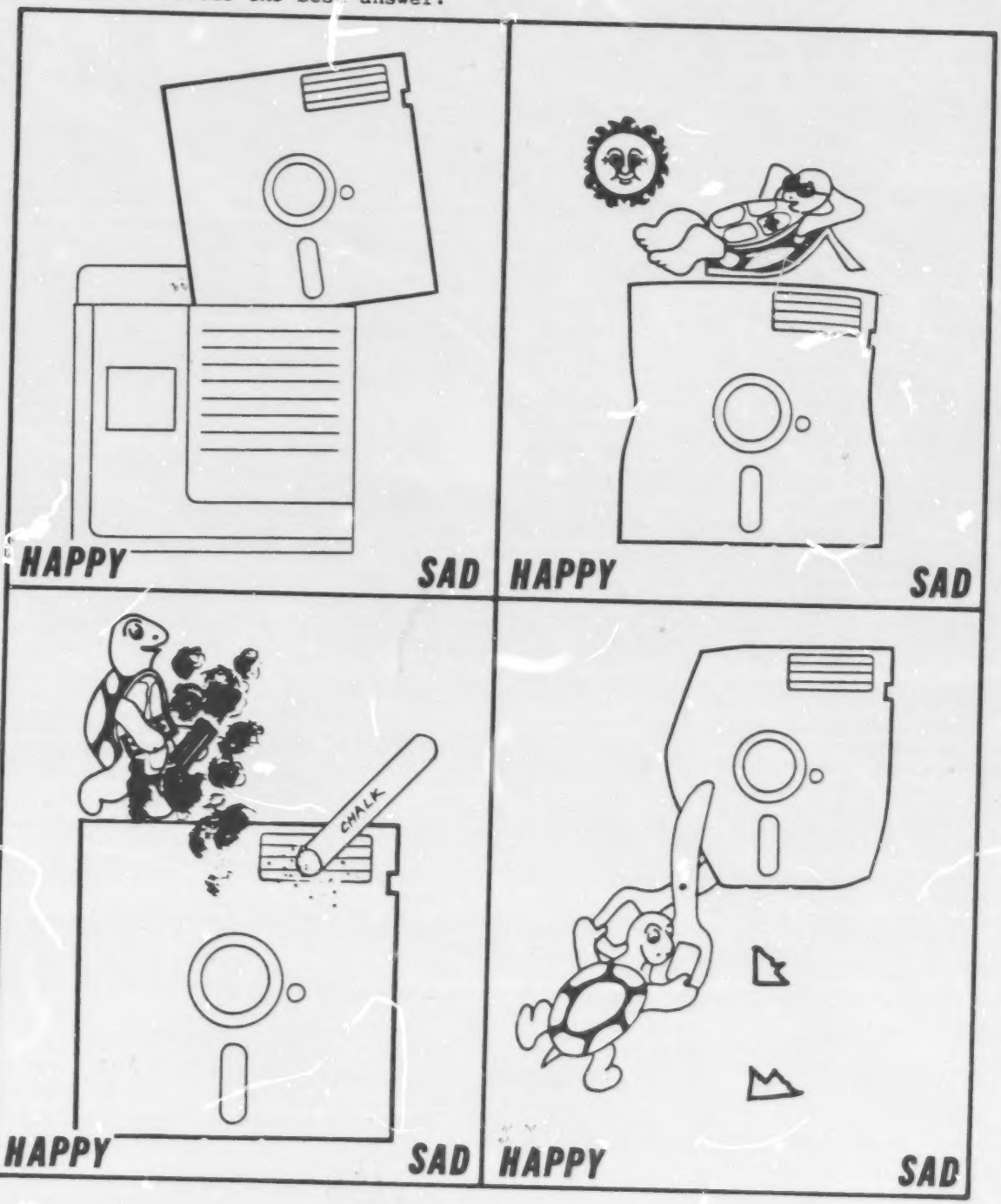
I-2-8
Level 3
LA
P.1 of 2

Happy or Sad?

DISKETTE

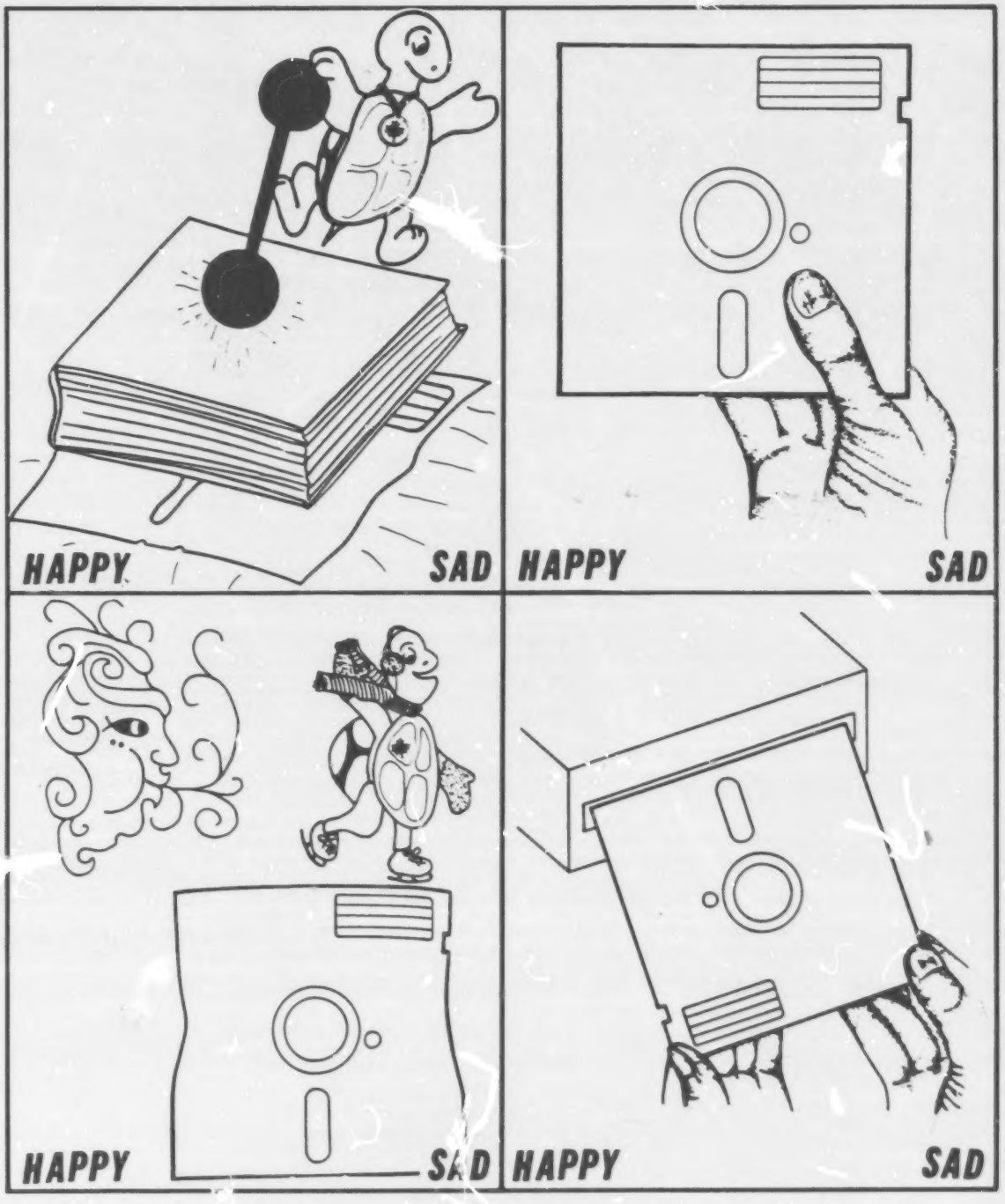
DIRECTIONS:

1. Examine each picture.
2. If a diskette had feelings, would it feel happy or sad about the situation? Circle the best answer.



109

I-2-8
Level 3
LA
P.2 of 2



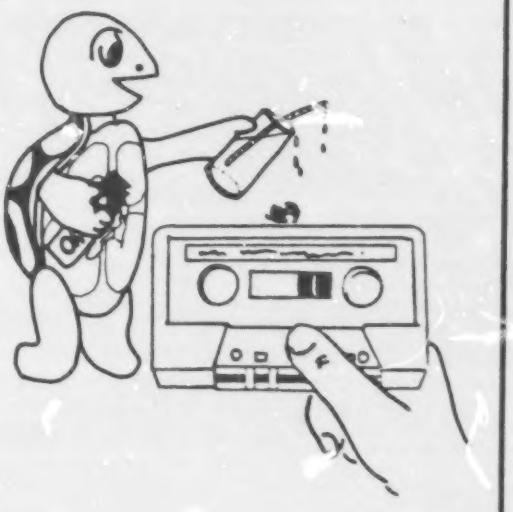
110

Happy or Sad? Cassette

I-2-9
Level 3
LA
P.1 of 1

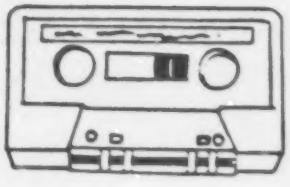
DIRECTIONS:

1. Examine each picture.
2. If a cassette had feelings, would it feel happy or sad about the situation? Circle the best answer.



HAPPY SAD

HAPPY SAD



HAPPY SAD

HAPPY SAD

111

Starting Steps

I-3-1
Level 2
LA/Sc
P.1 of 2

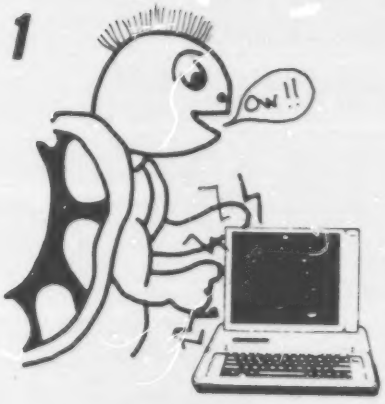
DIRECTIONS:

1. This is a small group activity in which the teacher prepares a set of picture cards, each one illustrating one step in booting the microcomputer. The drawings provided may be glued to larger cards and laminated. These illustrations have been prepared for the Apple microcomputer. Teachers with other models of microcomputers may find it necessary to modify the illustrations.

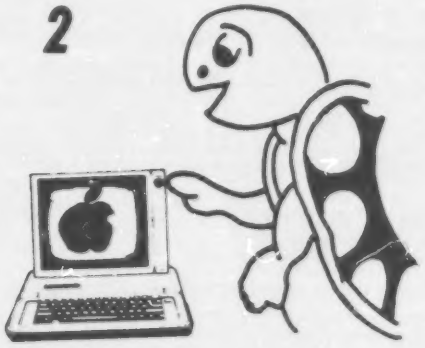
2. Students should arrange the cards in the correct sequence. Note that young students may have difficulty sequencing seven steps. For this reason, it is recommended that the sequence be developed using three steps, then four steps, etc.

3. As a follow-up activity, students can draw their own set of sequence pictures and these can be put into a booklet.

112

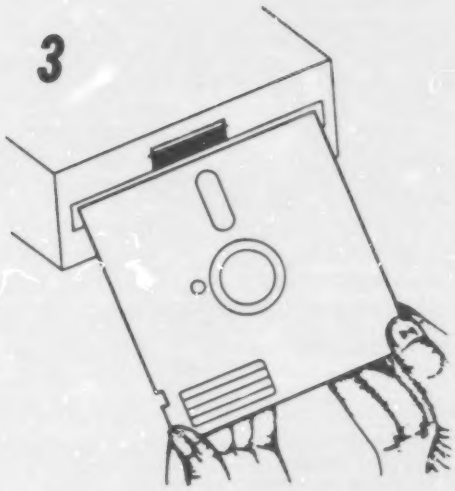


GROUND YOURSELF



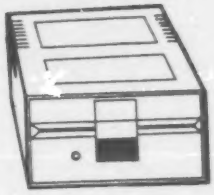
TURN ON THE MONITOR

3



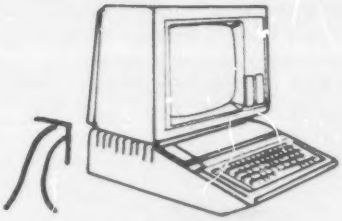
INSERT THE DISKETTE FACE UP
INTO THE SLOT IN DRIVE 1

4



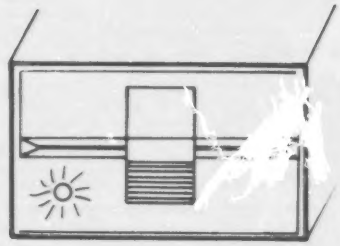
CLOSE THE DOOR
OF THE DISK DRIVE

5



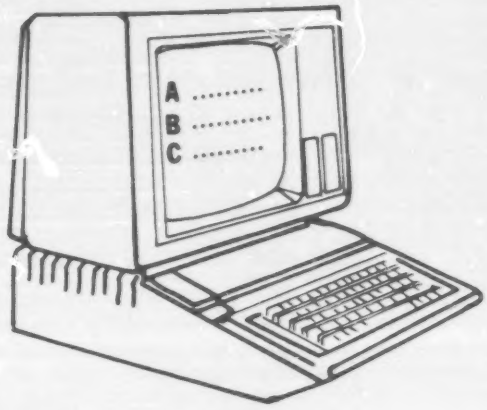
TURN ON THE POWER SWITCH
AT THE BACK
OF THE MICROCOMPUTER

6



WAIT UNTIL THE RED LIGHT
ON THE FRONT OF THE DISK DRIVE
GOES OFF FOR THE FIRST TIME

7



MAKE YOUR
PROGRAM SELECTION FROM
THE MENU ON THE SCREEN

113

"BOOTING" MICROCOMPUTERS

I-3-2
Level 3
LA/Sc/SS
P.1 of 4

DIRECTIONS FOR "BOOT" THE APPLE GAME:

Cut out the boxes and arrange the steps in order on the game board.

Variations:

1. How long does it take to put the boxes in order? Are you faster than your friend?
2. Put the boxes in order on the game board. Remove one box. Ask your friend to identify the missing step.
4. Put the boxes in order on the game board. Mix up two steps. Ask your friend to locate the mix-up.

114

INSERT THE DISKETTE FACE UP INTO THE SLOT IN DRIVE 1	TURN ON THE MONITOR
GROUND YOURSELF	MAKE YOUR PROGRAM SELECTION FROM THE MENU ON THE SCREEN
WAIT UNTIL THE RED LIGHT ON THE FRONT OF THE DISK DRIVE GOES OFF FOR THE FIRST TIME	TURN ON THE POWER SWITCH AT THE BACK OF THE MICROCOMPUTER
CLOSE THE DOOR OF THE DISK DRIVE	

DIRECTIONS FOR "BOOT" THE COMMODORE GAME:

Cut out the boxes and arrange the steps in order on the game board (p. 4).

Variations:

1. How long does it take to put the boxes in order? Are you faster than your friend?
2. Put the boxes in order on the game board. Remove one box. Ask your friend to identify the missing step.
3. Put the boxes in order on the game board. Mix up two steps. Ask your friend to locate the mix-up.

115

TURN ON THE DISK DRIVE	GROUND YOURSELF
PRESS <SHIFT> and <RUN/STOP> AT THE SAME TIME	CLOSE THE DOOR OF THE DISK DRIVE
INSERT THE DISKETTE FACE UP INTO THE SLOT IN DRIVE ⓓ	MAKE YOUR PROGRAM SELECTION FROM THE MENU ON THE SCREEN
	TURN ON THE COMMODORE MICROCOMPUTER

DIRECTIONS FOR "BOOT" THE TRS-80 GAME:

Cut out the boxes and arrange the steps in order on the game board (p. 4).

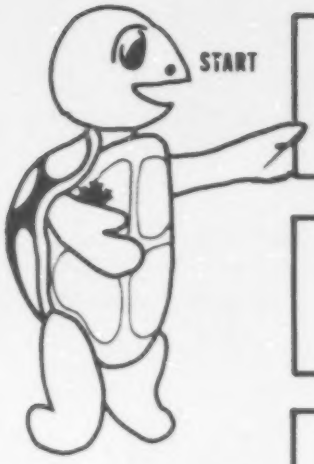
Variations.

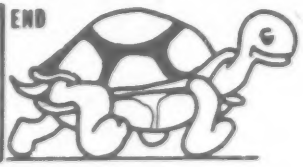
1. How long does it take to put the boxes in order? Are you faster than your friend?
2. Put the boxes in order on the game board. Remove one box. Ask your friend to identify the missing step.
3. Put the boxes in order on the game board. Mix up two steps. Ask your friend to locate the mix-up.

116

WAIT UNTIL THE RED LIGHT ON THE DISK DRIVE GOES OFF	CLOSE THE DOOR OF THE DISK DRIVE AND PRESS THE ORANGE (RESET) BUTTON
MAKE YOUR PROGRAM SELECTION FROM THE MENU ON THE SCREEN	TURN ON THE POWER SWITCH ON THE RIGHT SIDE OF THE KEYBOARD
GROUND YOURSELF	WAIT UNTIL THE RED LIGHT ON THE DISK DRIVE GOES OFF AND THEN PRESS THE ORANGE (RESET) BUTTON AGAIN
	INSERT THE DISKETTE FACE UP INTO THE SLOT IN THE BOTTOM DISK DRIVE

"BOOTING" MICROCOMPUTERS GAMEBOARD





117

COMPUTER POETRY

I-3-3
Level 2
LA/Teacher Utility
P.1 of 2

DIRECTIONS:

After brainstorming for ideas on the use and care of the computer, present this poem. Write the poem on a piece of tag board cut in the shape of a computer and leave it hanging over the microcomputer.

Five Shiny Micros

Five shiny micros lined up in a row,
The first one displayed, "Spill food on us? Oh no!"
The second one displayed, "We don't like dust nor bugs."
The third one displayed, "When you're finished pull the plugs."
The fourth one displayed, "A micro's not a lark!"
The fifth one displayed, "Touch metal to de-spark."
So flip went the switch
And whir-r went the drive
And ready for use were the micros five!

118

Activity suggestions:

1. Have the students explain in their own words what each line means. Groups of students should take the parts of the five microcomputers and the narrator. The class could chant the poem together.

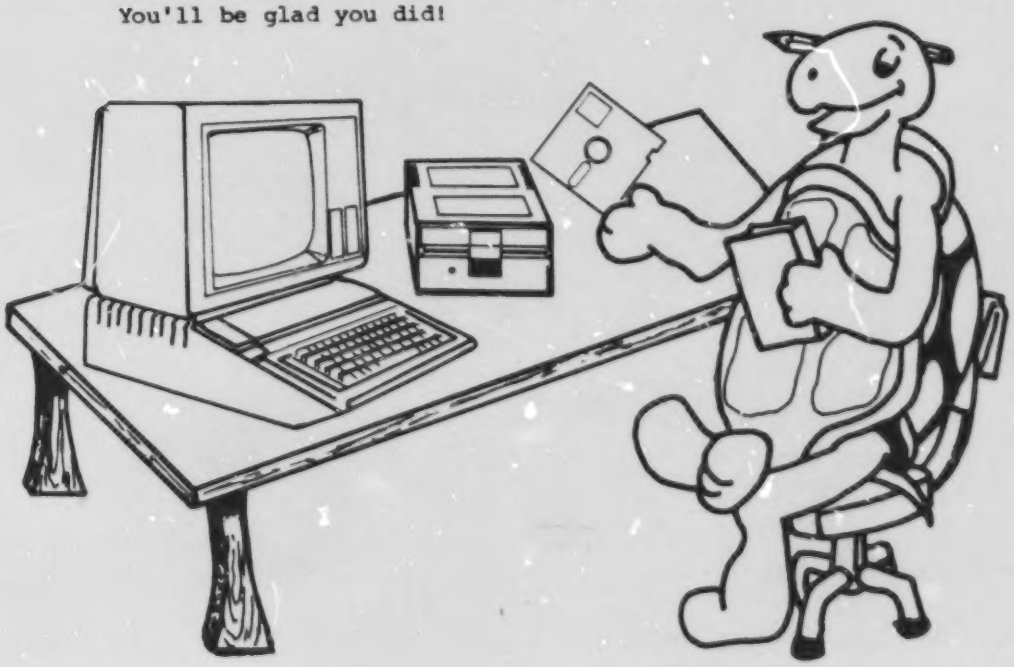
2. Discuss what the quotation marks mean and why they are used.

3. Five students could make small paper microcomputers mounted on popsicle sticks. Each micro should have a quotation from the poem printed on it. While reciting the poem students would hold up their micro at the appropriate time.

What's that sitting on the desk over there?
My it gave me a funny stare.
Blink! Blink!
Now what was that . . .
Why it's only a computer
So down we sat.

Super Computer, all ready to go.
Don't touch wires or plugs you know
And THEN
Put the disk in the drive
Make the power come alive
Check the screen for your mode
Now type in your code.

Take care of the diskettes
Please, oh please
Never leave them in the cold to freeze
Only in containers should they be
Heat and dust are bad you see!
Put me in gently and
Close the lid.
I'm ready to help you
You'll be glad you did!



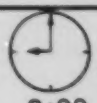
Timetable for Microcomputing

I-4-1
Levels 2,3
Math/Sc/SS/
Teacher
Utility
P.1 of 2

DIRECTIONS:

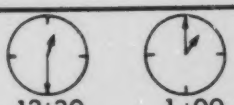
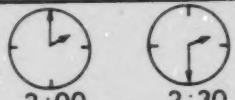
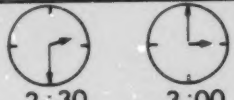
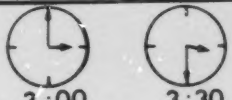
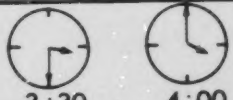
The teacher should prepare large morning and afternoon timetables using appropriate time intervals on the left and school day designations across the top. Leave enough space to print or otherwise enter the names of students who will be using the computer in each time slot.

Morning

START	STOP	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6
8:30	 9:00						
9:00	9:30						
9:30	10:00						
10:00	10:30						
10:30	11:00						
11:00	11:30						
11:30	12:00						
12:00	12:30						

120

AFTERNOON

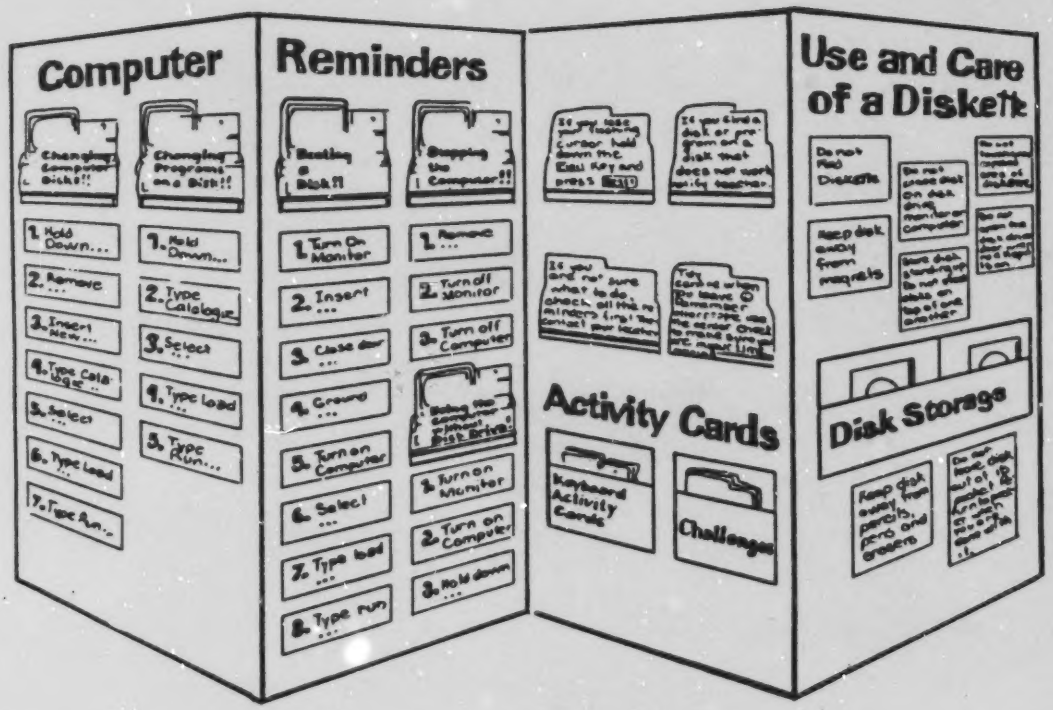
	DAY 1	DAY 2	DAY 3	DAY 3	DAY 4	DAY 6
 12:30 1:00						
1:00 1:30						
1:30 2:00						
 2:00 2:30						
 2:30 3:00						
 3:00 3:30						
 3:30 4:00						

121

I-5-1
Levels K,1,2,3
LA/Math/Sc/SS/
Other
P.1 of 1

Computer

Learning Centre



BEST COPY AVAILABLE

Proficiency Checklist

I-5-2
Level 3
Teacher
Utility
P.1 of 1

The student:

	YES	NO
grounds herself/himself		
inserts diskette or cassette properly		
turns on power for the computer and the input/output devices		
can use a prepared program in the computer		
can turn the computer system off properly		
stores cassette/diskette properly		
shows respect and responsibility for equipment		
shows respect and responsibility for scheduling rules		

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Computer Operator's Licenses

I-5-3
Level 3
Teacher
Utility
P.1 of 2

DIRECTIONS:

After students have demonstrated sufficient skill in operating the microcomputer, the teacher could provide students with personalized pocket-sized certificates. These could be laminated for durability and could be displayed at the machine when students are working independently.

.....

HAS LEARNED THE BASIC OPERATIONS OF THE COMPUTER

AND IS HEREBY AWARDED A

apple

COMPUTER
OPERATOR'S
LICENSE

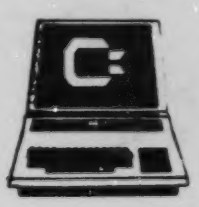
DATE..... TEACHER.....

.....

HAS LEARNED THE BASIC OPERATIONS OF THE COMPUTER

AND IS HEREBY AWARDED A

COMMODORE



COMPUTER
OPERATOR'S
LICENSE

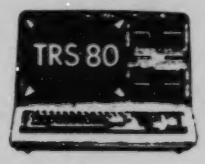
DATE..... TEACHER.....

.....

HAS LEARNED THE BASIC OPERATIONS OF THE COMPUTER

AND IS HEREBY AWARDED A

TRS-80



COMPUTER
OPERATOR'S
LICENSE

DATE..... TEACHER.....

125

.....

HAS LEARNED THE BASIC OPERATIONS OF THE COMPUTER

AND IS HEREBY AWARDED A

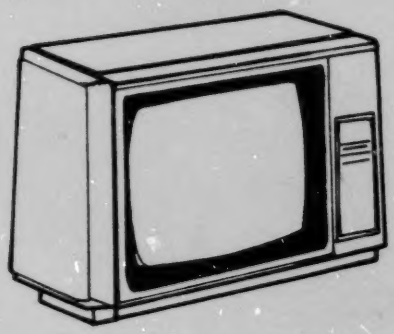
COMPUTER
OPERATOR'S
LICENSE

DATE..... TEACHER.....

Name Game

II-2-1
Level 2
LA/Sc
P.1 of 2

Name Each Picture:



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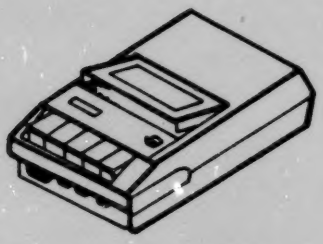

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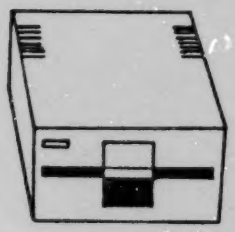

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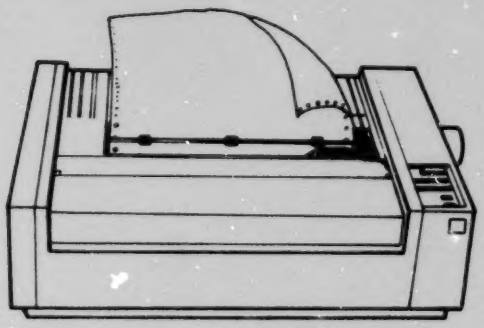

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126

Print the name of each item where it belongs:

Input

.....

.....

.....

Output

.....

.....

.....

Storage Media

.....

.....

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127

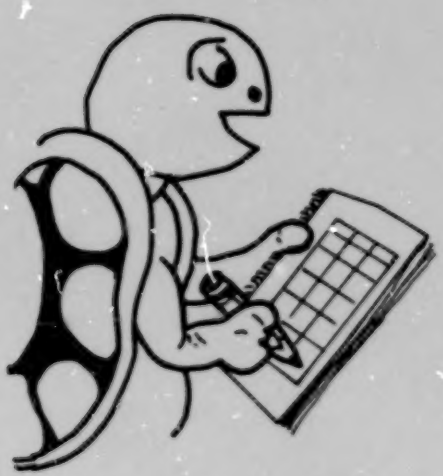
A · B · Computer Words

II-2-2
Level 3
LA
P.1 of 1

DIRECTIONS:

Arrange these computer words in alphabetical order.

microcomputer	keyboard
output	monitor
cassette	diskette
printer	tape recorder
disk drive	hardware
software	input



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____

128

Input - Processing - Output

II-2-3
Level 2
LA/Math/Sc/
Teacher
Utility
P.1 of 1

DIRECTIONS:

1. Have the students suggest activities which involve input-processing-output. List these activities in the left hand column of a large chart.

2. Select a number of activities which students could do at school or at home. Through a class discussion of each activity, determine the input, processing and output in order to complete the chart.

Sample Chart:

ACTIVITY	INPUT	PROCESSING	OUTPUT
Making Popcorn	Put kernels in pan with butter and turn on stove.	Kernels cook and pop.	Popcorn
Washing Dishes	Put dishes in sink with water and soap.	Wash dishes.	Clean dishes

129

Input - Output

II-2-4
Level 3
LA
P.1 of 2

DIRECTIONS:

Find each of the following words. Words may be arranged diagonally, up and down, sideways, forward or backward.

keyboard	hardware	output
disk drive	printer	computer
diskette	cassette	monitor
input		

Y C Q V C X N B V Q G B M A E V
N R H U A F O E L P B K O R F Q
S U K S S Y T U Q T C B A C Q T
K V G C T E P Z J U E W B V R D
B X E V I R D K S I D Y E H N U
R H N D S E L M I R O T I N O M
D I S K E T T E A R T D E L H N
T F H B T U W H M E J K R J X P
B I T R I P D J S T K C Q F U X
O Y N U D M R S P N N E G C M L
X D W P I O A B Q I A D F O U A
Y Q A R U C O N I R Y J D V X K
N A E T P T B S Q P A Y W S M J
I R P C T H Y N V W Y L V O I A
P U U S J J E L S V D A Z Z P P
T A A F X H K I R M M C M P V G

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ANSWERS FOR "Input - Output"

```
. . . . . E .
. . . . . R . .
. . . . . A . . .
. . . . . W . . . .
. . EVIRDKSID.E . . .
. . . . . E . . . ROTINOM
DISKETTEART . . . . .
. . . . . U . H . E . . . . .
. I . . . P D . S T . . . . .
. . N . . M R S . N . . . . .
. . . P . O A . . I . . . . .
. . . . U C O . . R . . . . .
. . . T . T B . . P . . . . .
. . P . . . Y . . . . . .
. U . . . . E . . . . . .
T . . . . . K . . . . . .
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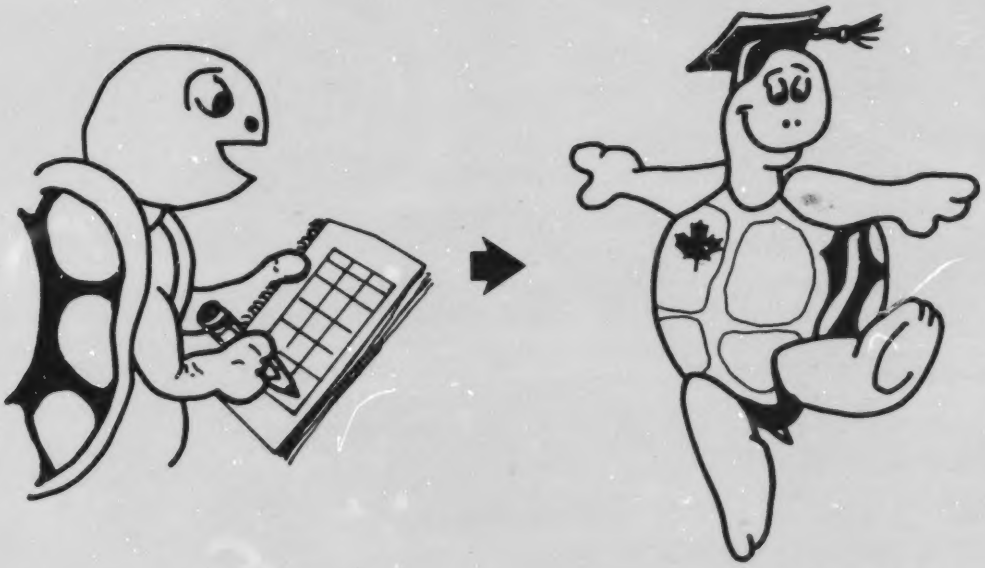


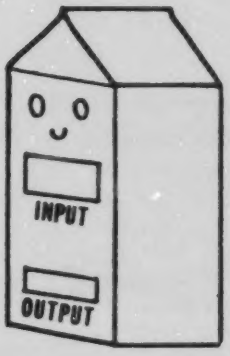
Computer Construction

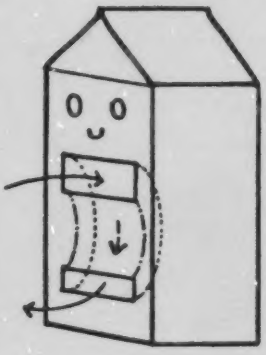
II-2-5
Level 2
LA/Art
P.1 of 1

DIRECTIONS:

Students can make their own computer using an empty two litre milk carton, a shoe box or any other suitable container.

Cut a small slit near the top of the carton and another near the bottom of the carton. On the inside, tape two strips of manilla tag joining the two slits to make a pathway--or slide to carry a card. Students should be encouraged to decorate their "computer" using foil, buttons, pipecleaners, cloth, paint, etc.





Students are to prepare some cards which will fit through the slot in their "computer." Each card is to have a question on one side and the answer on the other. Students place the card, question side up, in the input slot and push it into the computer. When the card begins to appear in the output slot, pull it through to reveal the answer.

132

Peanut Butter and Jelly

II-3-1
Levels 2,3
LA/SS/Teacher Utility
P.1 of 2

DIRECTIONS:

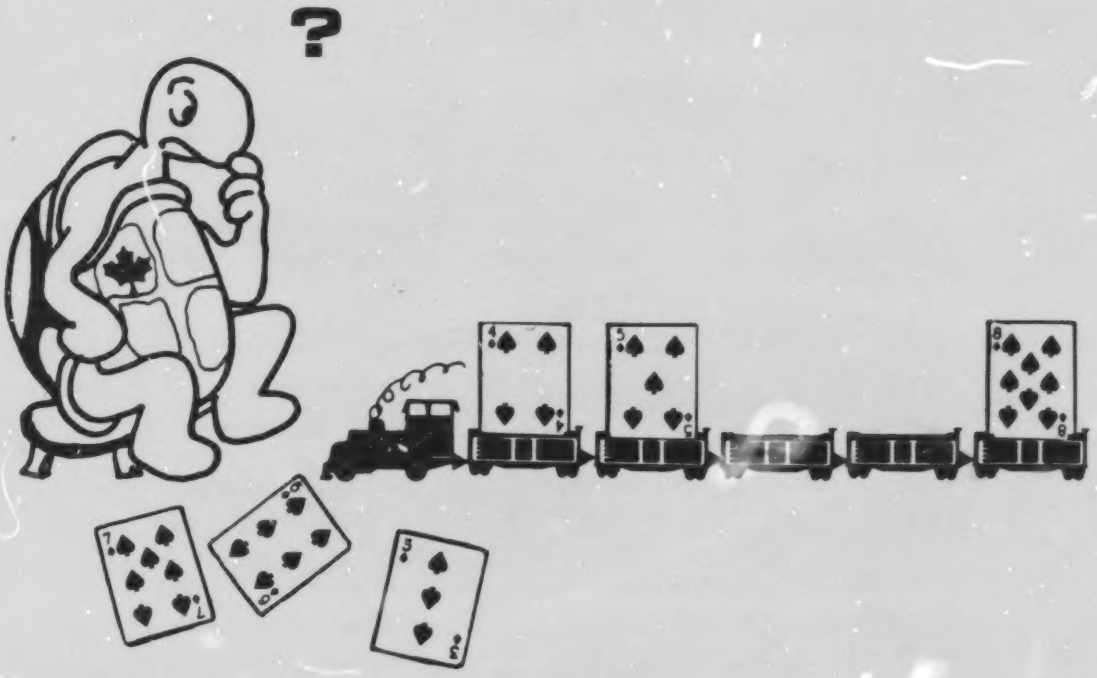
1. Have groups of students write the directions for making a peanut butter and jelly sandwich.

2. The teacher selects one set of directions to follow in a class demonstration of making a sandwich. See the sample on the next page.

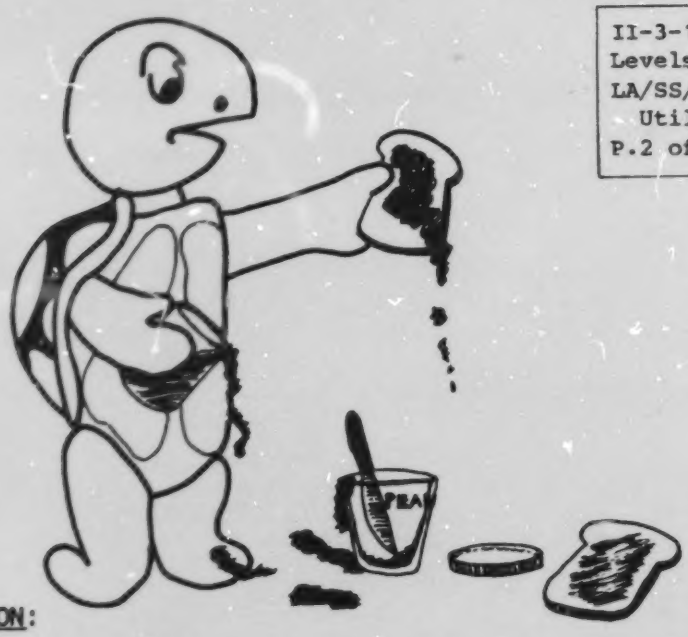
3. Students soon see that "fuzzy" directions can produce unexpected results. Have students rewrite their directions so that they are as foolproof as possible. Class discussion should follow.

4. If students have written the directions in paragraph form, have the students rewrite them in the form of a numbered list.

5. When discussing each group's list, omissions may be noticed. Add these and renumber the list.



133



SAMPLE DEMONSTRATION:

The teacher is to follow the directions accurately though in as unconventional a way as possible.

. "Take two slices of bread."	
. "Open the jar of peanut butter."	
. "Spread peanut butter on one side of one slice of bread."	(Here is the teacher's chance to follow the directions, but not as they were intended. Reach into the jar and scoop out some peanut butter, smearing it onto the slice of bread with your fingers. No knife was specified so choose not to use one.)
. "Now open the jar of jelly."	(Do this . . . but not before licking the remaining peanut butter off your fingers.)
. "Spread jelly on one side of the other slice of bread."	(The teacher may wish to use the same hand again.)
. "Put the two slices of bread together."	(Do this, but put the sides smeared with the peanut butter and jelly facing out, and hand it to a student to eat.)

Does It Float ?

MATERIALS:

Collection of objects, some of which will float, some of which will float if placed in water in a certain position, and some of which will sink.

Large pan, preferably transparent, with water.

Large piece of paper and markers for making a chart such as the sample found at the end.

DIRECTIONS:

1. Introduce the activity to the students by having them look at the collection of objects and talk about which will float and which will sink.

2. Tell students that they are going to make a big chart that will tell about all of these objects--which ones float and which ones sink. Then explain that the class will make a procedure. Ask: "If we want to know which objects float and which ones sink, what will we do first?"

   Have students suggest a first step, and have a student carry out the step, e.g., "Pick up an object from the pile and say whether you think it will float." Write the step on the chalkboard.

   Ask the following questions:

   . "What happens next?" (For example, "Put it in the water.")

   . "What will we do next?" (For example, "Watch it float.")

   . "What next?" (For example, "Write on the chart that it floats.")

3. Continue working with the class to develop a procedure that will work reasonably well (it may have some bugs in it). Have students take turns following the procedure. For example, one child may choose an object, put it in the water, observe whether it floats or sinks, and report to the teacher, who writes the information on the big chart. Encourage students to follow the procedure exactly in the way agreed upon.

4. As students follow the procedure, work with them to help recognize missing steps in the procedure. For example, if students keep on putting objects into the water and never take any out, the pan will become full of objects.

   Ask: "Does our procedure handle cases in which an object appears first to float but later sinks? How long should we wait until we decide whether the object will float or not? Should we change our chart to show that an object first floated and then sank?"

   Ask: "How do we know when we are done? Does our procedure tell when to stop?"

Object	Will it float?
block of wood	yes
paper cup	yes
lid	floats right side up, not upside down

(Courtesy of Prentice-Hall Canada, Inc. Reprinted from Hunter, Beverly. My Students Use Computers: Learning Activities for Computer Literacy. Reston, Virginia: Reston Publishing Company, 1983.)

Order *Please*

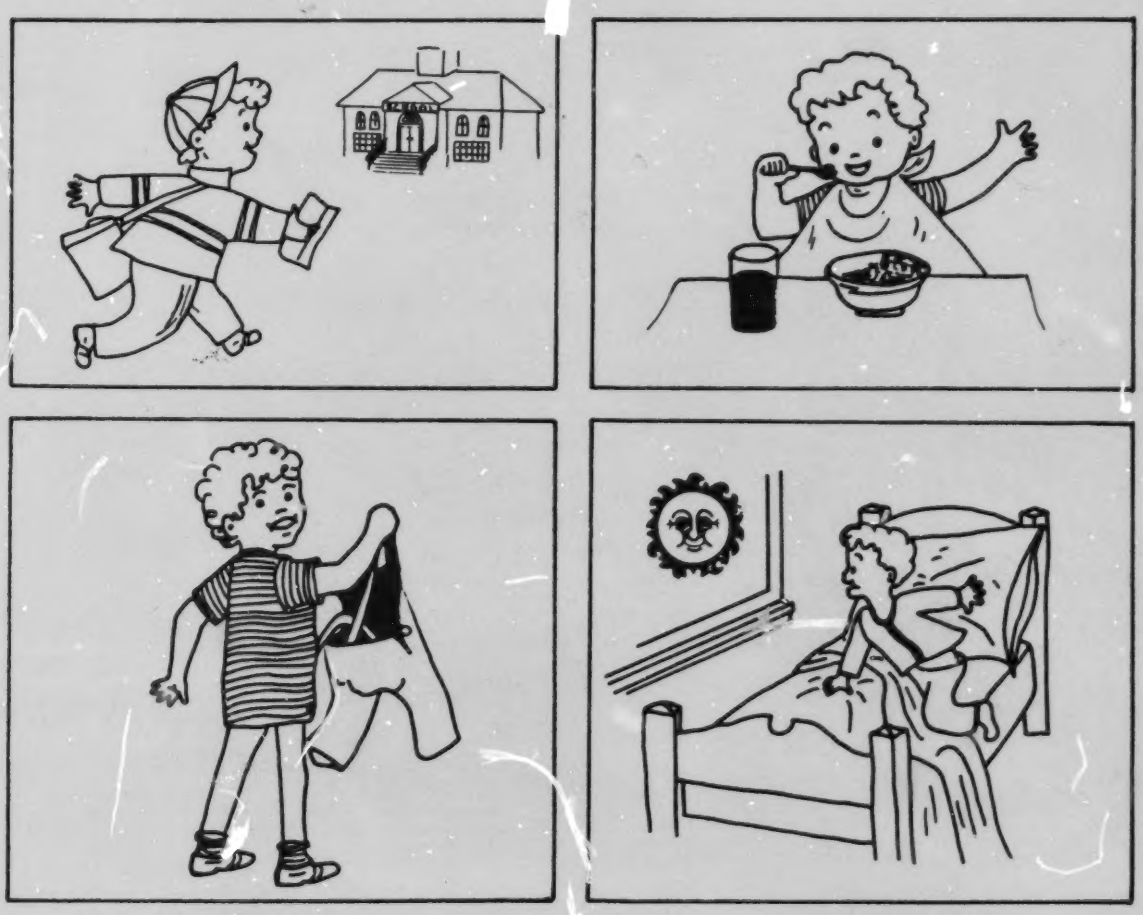
II-3-3
Levels 2,3
LA/Teacher
Utility
P.1 of 1

DIRECTIONS:

1. This is an activity that can be used at a learning centre. Select a series of pictures or cartoons from various sources such as newspapers or magazines. Each frame should be cut out, mounted, numbered on the back and laminated.

2. The student is to place the frames in order and then to check the numbers on the back to see if they are in the proper sequence.

   Difficulty can be varied by selecting pictures/cartoons with lots of action and little dialogue or cartoons with lots of dialogue and less action.



137

Demonstration Computer Programs

II-4-1
Level 2
Teacher
Utility
P.1 of 2

DIRECTIONS:

Teachers may wish to use the following programs for demonstration with small groups.

NEW
10 PRINT "COMPUTERS ARE FUN"
20 GOTO 10
RUN

NEW
10 PRINT "1234567";
20 GOTO 10
RUN

NEW
10 PRINT "COMPUTERS"
20 PRINT "ARE"
30 PRINT "FUN"
RUN

139

Calculator Definitions !

III-1-1
Levels 2,3
LA/Hands-on
P.1 of 2

DIRECTIONS:

Using page 2 of this activity as the students' activity sheet, the teacher could instruct students to:

1. Try to guess the WORD which each DEFINITION describes.
2. Key in the NUMBER CODE on the calculator.
3. Turn the calculator upside down to read the correct WORD. Was your guess correct?
4. Write sentences using some of these NUMBER CODES.

ANSWER KEY:

DEFINITION	NUMBER CODE	ANSWER WORD
1. To exist	38	BE
2. An insect	338	BEE
3. A hollow object that rings	7738	BELL
4. Giant size	918	BIG
5. What a baby wears at mealtime	818	BIB
6. To bubble up	7108	BOIL
7. What a chicken lays	993	EGG
8. The covering of an egg	77345993	EGGShELL
9. A girl's name	31573	ELSIE
10. What we do with our eyes	335	SEE
11. A snoring sound	2222	ZZZZ
12. A little mountain	7714	hILL
13. A short friendly greeting	14	hI
14. Something to wear on your feet	53045	ShOES
15. Sick	771	ILL
16. A cry	805	SOB
17. Not as much	5537	LESS
18. Another word for boy	34	hE
19. Another word for girl	345	ShE

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DEFINITION	NUMBER CODE	ANSWER WORD
1. To exist	38	_ _
2. An insect	338	_ _ _
3. A hollow object that rings	7738	_ _ _ _
4. Giant size	918	_ _ _
5. What a baby wears at mealtime	818	_ _ _
6. To bubble up	7108	_ _ _ _
7. What a chicken lays	993	_ _ _
8. The covering of an egg	77345993	_ _ _ _ _ _ _ _
9. A girl's name	31573	_ _ _ _ _
10. What we do with our eyes	335	_ _ _
11. A snoring sound	2222	_ _ _ _
12. A little mountain	7714	_ _ _ _
13. A short friendly greeting	14	_ _
14. Something to wear on your feet	53045	_ _ _ _ _
15. Sick	771	_ _ _
16. A cry	805	_ _ _
17. Not as much	5537	_ _ _ _
18. Another word for boy	34	_ _
19. Another word for girl	345	_ _ _

Note: Teachers using this material with grade 2 students may need to enlarge the print size.

Calculator Definitions II

III-1-2
Level 3
LA/Hands-on
P.1 of 2

DIRECTIONS:

Using page 2 of this activity as the students' activity sheet, the teacher could instruct students to:

1. Try to guess the WORD which each DEFINITION describes.
2. Key in the NUMBER CODE on the calculator.
3. Turn the calculator upside down to read the correct WORD. Was your guess correct?
4. Write sentences using some of these NUMBER CODES.

ANSWER KEY:

	DEFINITION	NUMBER CODE	ANSWER WORD
1.	Great joy or happiness	55178	BLISS
2.	A small mass or splash of colour	8076	BLOB
3.	To confuse	379908	BOGGLE
*4.	A scare	0.08	BOO
*5.	A crying sound	0.04008	BOOhOO
6.	The person in charge	5508	BOSS
*7.	The name of a clown	0.208	BOZO
8.	A long snake-like fish	733	EEL
9.	The plural of goose	35339	GEESE
10.	A chuckle	379919	GIGGLE
11.	An organ used by fish to breathe	7719	GILL
12.	A lump of something	8079	GLOB
*13.	To move	0.9	GO
*14.	Short form for "she will"	77.345	ShE'LL
*15.	Short form for "he will"	77.34	hE'LL
*16.	A place to see wild animals	0.02	ZOO
17.	Belongs to him	514	hIS
18.	Short form of sister	515	SIS
19.	Sound made by a snake	5514	hISS
20.	Opposite of buy	7735	SELL
*21.	A greeting	0.7734	hELLO

*The teacher may wish to omit these words as they require the students to use the decimal key on the calculator.

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DEFINITION	NUMBER CODE	ANSWER WORD
1. Great joy or happiness	55178	_ _ _ _ _
2. A small mass or splash of colour	8076	_ _ _ _
3. To confuse	379908	_ _ _ _ _ _
4. A scare	0.08	_ _ _
5. A crying sound	0.04008	_ _ _ _ _ _
6. The person in charge	5508	_ _ _ _
7. The name of a clown	0.208	_ _ _ _
8. A long snake-like fish	733	_ _ _
9. The plural of goose	35339	_ _ _ _ _
10. A chuckle	379919	_ _ _ _ _ _
11. An organ used by fish to breathe	7719	_ _ _ _
12. A lump of something	8079	_ _ _ _
13. To move	0.9	_ _
14. Short form for "she will"	77.345	_ _ _ _ _
15. Short form for "he will"	77.34	_ _ _ _
16. A place to see wild animals	0.02	_ _ _
17. Belongs to him	514	_ _ _
18. Short form of sister	515	_ _ _
19. Sound made by a snake	5514	_ _ _ _
20. Opposite of buy	7735	_ _ _ _
21. A greeting	0.7734	_ _ _ _ _

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Mrs. Duck's Surprise

III-1-3
Level 2
LA/Hands-on
P.1 of 3

One day Mrs. Duck sat on her nest. All of a sudden _____ (345)
got a _____ (918) surprise. _____ (345) looked into her nest
and saw five _____ (5993). One _____ (993) was very
_____ (918). The other _____ (5993) were very small.
"Where did this _____ (918) _____ (993) come from?" said
Mrs. Duck. "I will _____ (09) and _____ (335).

Mrs. Duck met _____ (31573) the cow. "Did you put a
_____ (918) _____ (599) in my nest?" "NO," said
_____ (31573). "Cows don't lay _____ (5993)."

Then Mrs. Duck went to _____ the _____
335 5508

of the barnyard, Mr. _____, the horse. "Mr. _____,"
808 808

said the duck, "Did you put a _____ _____ in
918 993

my nest?" "Oh, no," said Mr. _____. "Horses don't
808

lay _____."
5993

145

Mrs. Duck did not know what to do. _____ went back to
345

her nest. Her _____ were not there. All she could
5993

_____ was a nest full of _____.
335 577345

Then Mrs. Duck started to _____. _____
379919 345

did not have to ask any more animals about the _____
918

_____. Mrs. Duck did not have _____ any
993 5993

more. _____ had four little ducklings and one
345

_____ _____. What a funny surprise!
918 35009

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Calculator Storybook

III-1-4
Level 3
LA/SS/
Hands-on
P.1 of 2

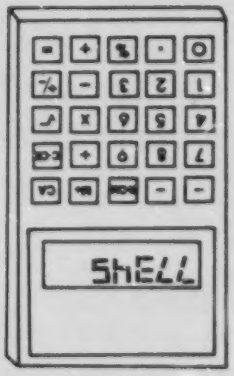
DIRECTIONS:

1. The class, directed by the teacher, should make a list of all the "calculator words" they have discovered from activity III-1-1 or III-1-2.

2. The class should categorize the list of calculator words. For example:

CALCULATOR WORDS

THINGS		PEOPLE	ACTION WORDS	OTHER WORDS
soil	eel	hobo	lie	ill
hill	gill	boss	sigh	big
hoe	eggs	Zoe	sell	she
hose	eggshell	Lee	boil	she'll
sleigh	bee	Liz	sob	he
zoo	bees	Lil	giggle	he'll
lego	goose	Bill	go	
heel	geese	Lee	see	
oil	bliss	sis	be	
bell	boo	Bob	boggle	
bib	boo hoo	Bozo		
bilge	boss	Elsie		
blob	hill	Elie		
glob				



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3. The students could brainstorm to create some possible story titles using the calculator words.

POSSIBLE STORY TITLES

The Day The Egg Cracked Open
The Big Blob
The Bell That Wanted To Ring
The Race Between the Eel and the Bee
How the Goose and Elsie Became Friends
How the Computer Became Ill
Bozo the Computer
The Goose That Would Not Giggle
Bees Bees Everywhere
At the Zoo

4. In groups or as individuals, the students could write and share a short story using one of the above titles. An example of this type of story is given in Activity III-1-3.

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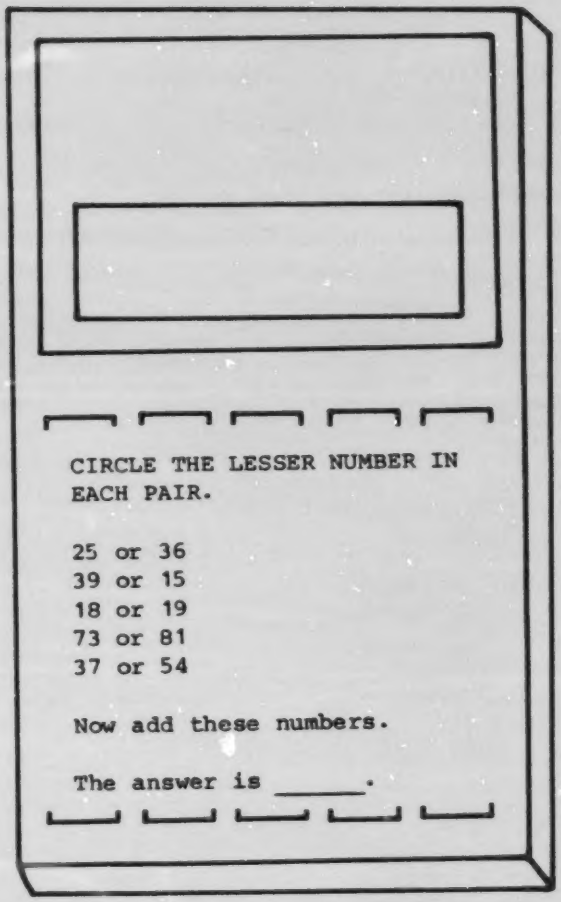
Calculator Addition

III-1-5
Level 3
Math/Hands-on
P.1 of 2

DIRECTIONS:

Use a calculator to solve each of the following problems. Fill in the answer in the space provided.

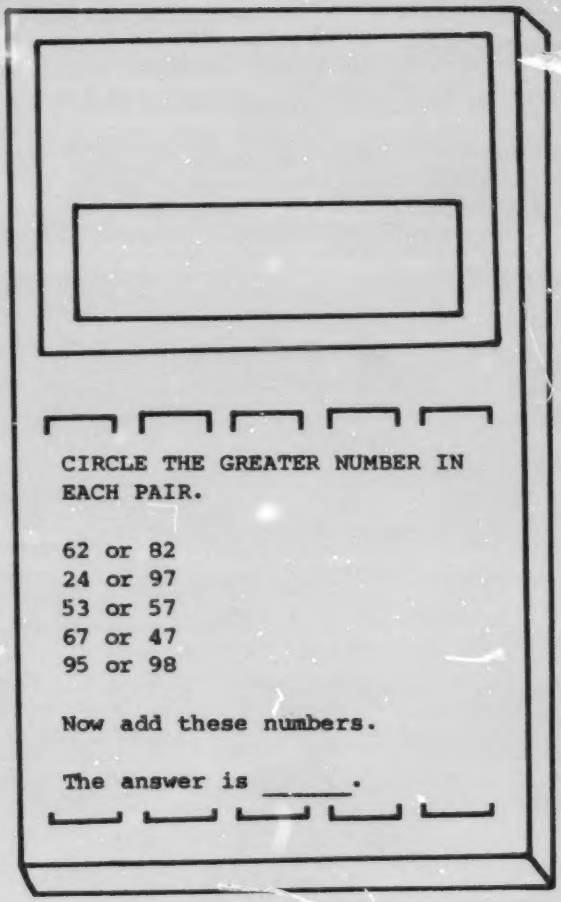


CIRCLE THE LESSER NUMBER IN EACH PAIR.

25 or 36
39 or 15
18 or 19
73 or 81
37 or 54

Now add these numbers.

The answer is _____.



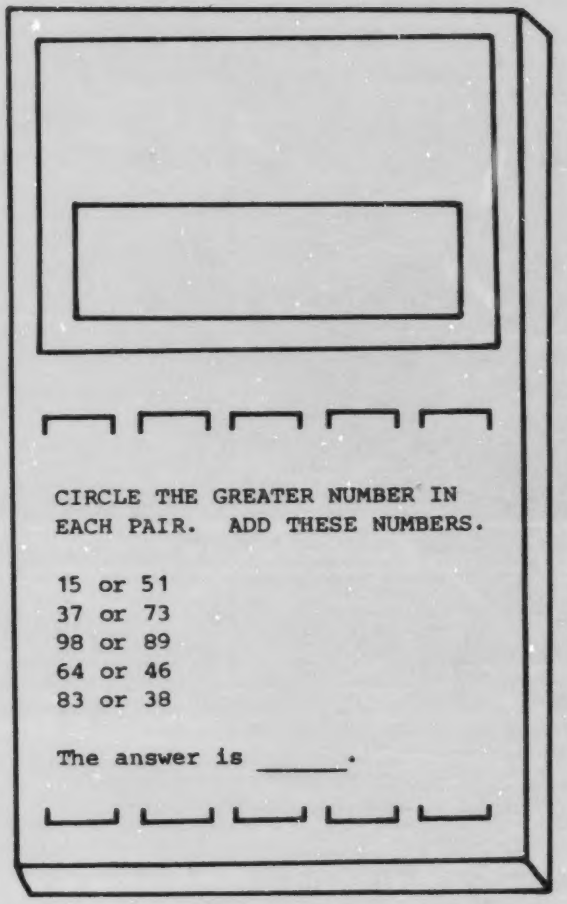
CIRCLE THE GREATER NUMBER IN EACH PAIR.

62 or 82
24 or 97
53 or 57
67 or 47
95 or 98

Now add these numbers.

The answer is _____.

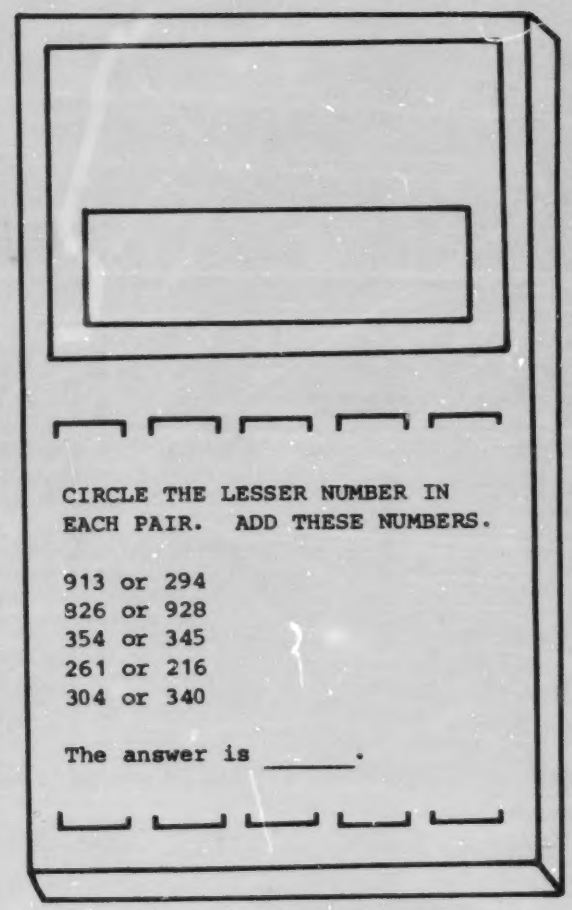
149



CIRCLE THE GREATER NUMBER IN EACH PAIR. ADD THESE NUMBERS.

15 or 51
37 or 73
98 or 89
64 or 46
83 or 38

The answer is _____.



CIRCLE THE LESSER NUMBER IN EACH PAIR. ADD THESE NUMBERS.

913 or 294
826 or 928
354 or 345
261 or 216
304 or 340

The answer is _____.

150

The teacher may wish to cut out these cards, laminate them and place them in an activity centre.

Calculator Magic

III-1-6
Level 3
Ma/Hands-on
P.1 of 2

DIRECTIONS:

Reproduce the activity cards which follow. Students are to use a calculator with each activity.

Calculator Magic

Activity 1:

Choose a number and enter it into your calculator. Then:

Add 125

Multiply by 20

Divide by 5

Subtract 500

Divide by 4

Press [=]

1. What number is displayed on your calculator? ____

2. Select another number and try again.

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Calculator Magic

Activity 2:

Enter your house number into a calculator. Then:

Multiply it by 2

Add 5

Multiply by 50

Add your age

Add the number of days in a year

Subtract 615

Press [=]

1. Look at the display. Is your house number and age displayed?

2. Practice and try this "magic" on a friend.

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EXTENSION:

Students could create their own "Calculator Magic" activity cards. For example make the answer equal 1985.

Computer Counting

III-1-7
Level 2
Ma/Teacher
Utility
P.1 of 2

DIRECTIONS:

1. Teachers could use the appropriate program from below to demonstrate how a computer counts. It may be necessary to consult the Operator's Manual to be able to enter this program in BASIC.

2. Once the program is entered, demonstrate for the class.

3. Using page 2 of this activity, have students determine if the computer can count faster than they can.

Apple

```
10 C=-4
20 HOME:F=0
30 C=C+4:F=F+1
40 PRINT C;TAB(10);C+1;TAB(20);C+2
50 IF F > 15 THEN 20
60 GO TO 30
Press CTRL/RESET keys to stop
```

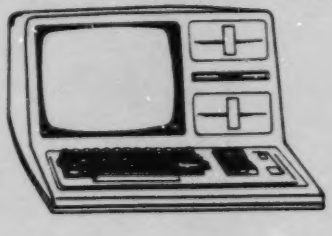
153

Commodore

```
10 C=-4
20 PRINT " ♥ ":F=0
30 C=C+4:F+F+1
40 PRINT C;TAB(10);C+1;TAB(20);C+2;TAB(30);C+3
50 IF F > 15 THEN 20
60 GO TO 30
Press RUN/STOP key to stop
```

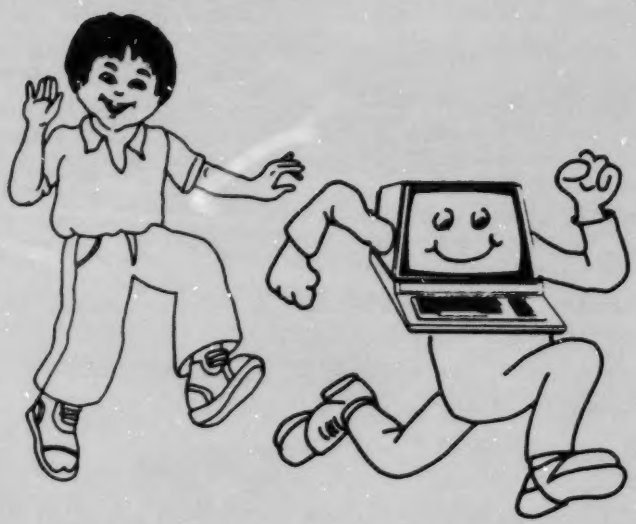
TRS-80

```
10 C=-4
20 CLS:F=0
30 C=C+4:F=F+1
40 PRINT C;TAB(10);C+1;TAB(20);C+2;TAB(30);C+3
50 IF F > 15 THEN 20
60 GO TO 30
Press BREAK key to stop
```



Are YOU Faster ?

	COMPUTER	STUDENTS
1. How high can you count in 1 minute?	..... highest number	..... highest number
2. How long does it take to count from 1 to 100?	..... time	..... time

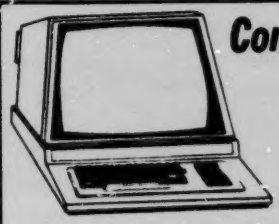


Can-Cannot Stories

III-2-1
Level 3
LA/Sc
P.1 of 2

DIRECTIONS:

Indicate what can best be done by computers or by people.



Computers can...

People can...

Note: Teachers may wish to enlarge the card format to provide increased answer space as appropriate for their students.

DIRECTIONS:

List what computers cannot do and what people cannot do as well as computers.

Computers cannot...

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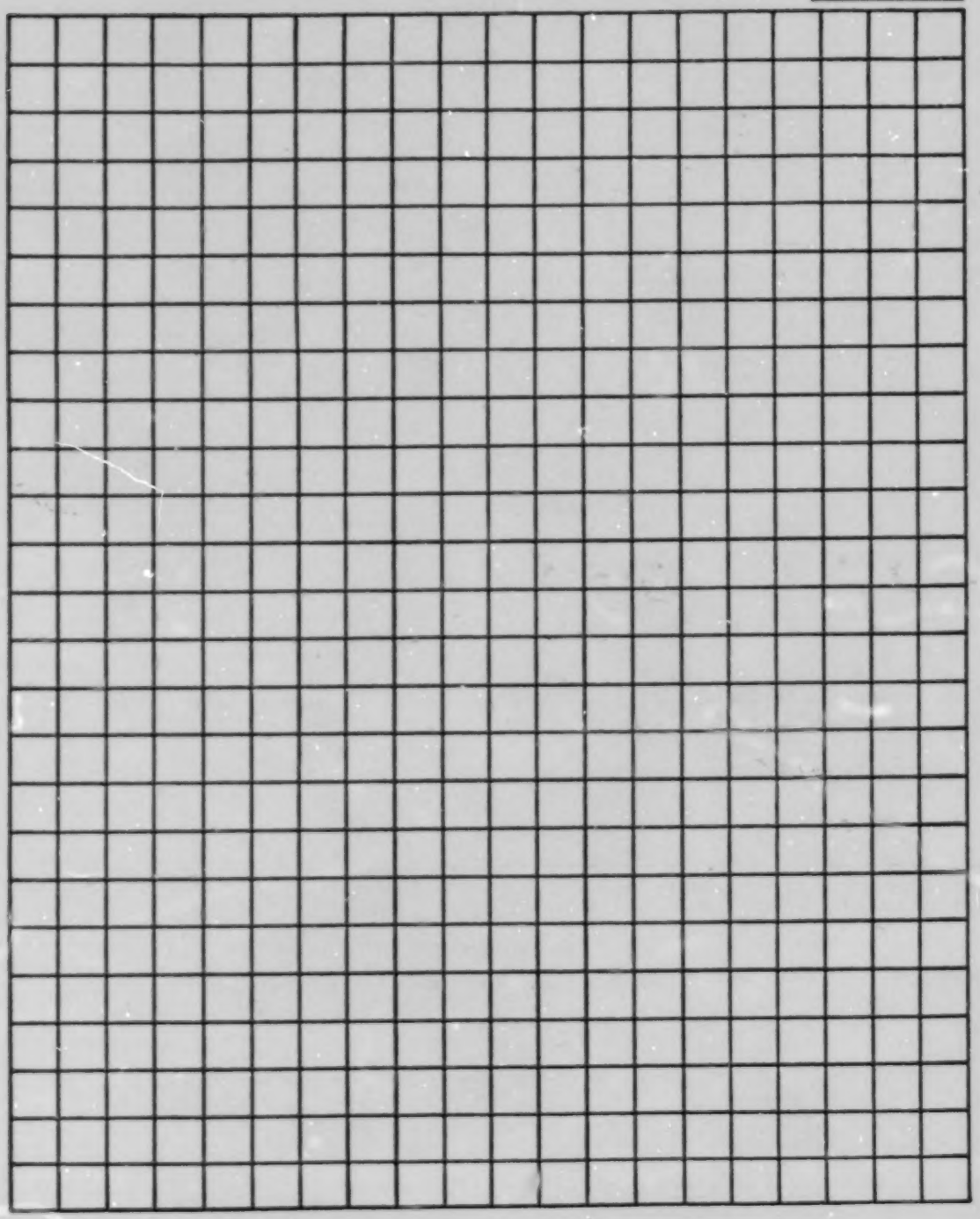
People cannot...

Video Drawing

IV-1-1
Levels 2,3
Ma/Teacher
Utility
P.1 of 1



157

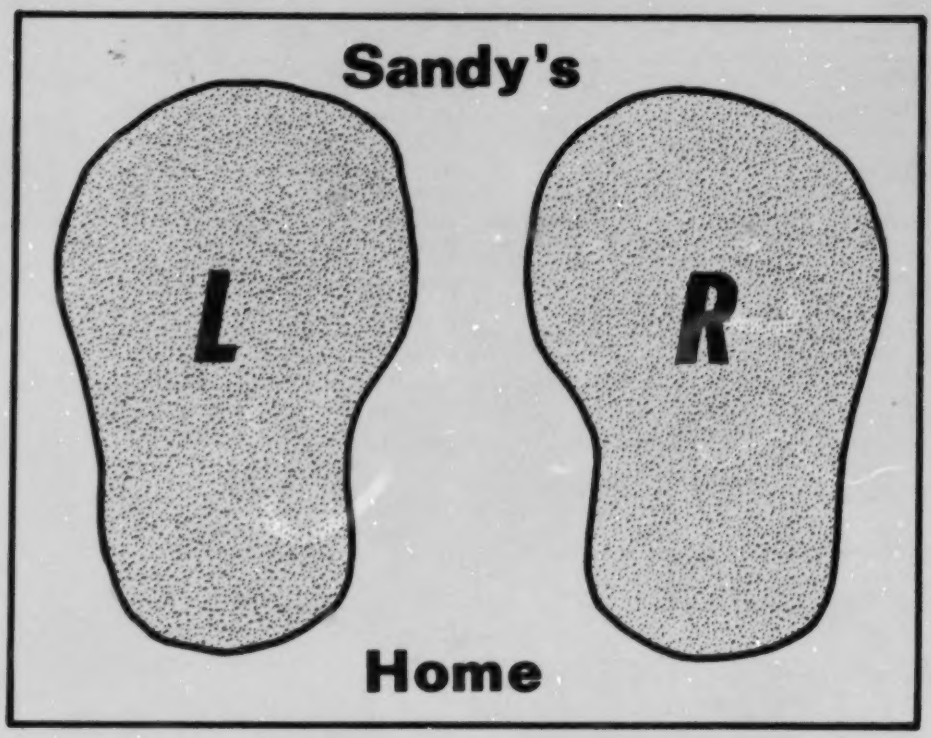
My Home

IV-2-1
Level K
Logo/Teacher
Utility
P.1 of 1

Each child should make a home base for use in Activity IV-2-2. The use of an aide or volunteer is recommended to assist with this activity.

DIRECTIONS:

1. Allow students to choose a piece of construction paper of any colour.
2. Each student stands on the construction paper and the volunteer traces the outline of the student's feet.
3. Have the student label the construction paper as illustrated. Replace Sandy's name with the student's name.



4. Laminate for durability.

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SIMON SAYS

IV-2-2
Level K
Logo
P.1 of 7

This activity is similar to the movement game "SIMON SAYS" except that the students respond to symbols rather than to verbal instructions. In this game, there are three or more "SIMONS". The students should be given the opportunity to be both a "SIMON" and a "human turtle". Each student not selected as a "SIMON" will be a "human turtle."

DIRECTIONS:

1. The teacher should prepare several laminated sets of the four symbol cards found in this activity.

2. Using the home base constructed in Activity IV-2-1, each "human turtle" chooses a starting place, puts the home base on the floor and stands on the footprints outlined on the home base. Each "human turtle's" home base remains fixed throughout this activity.

3. Select three students to be "SIMONS". These "SIMONS" face the class of "human turtles". Give each "SIMON" a set of symbol cards. Have the first "SIMON" select a card and hold it up for all to see.

4. The "human turtles" respond by turning a quarter turn or by taking a baby step in the appropriate direction.

5. The second "SIMON" selects a card and holds it up. The "human turtles" respond appropriately. Then the third "SIMON" selects and the "human turtles" respond.

6. At the end of the sequence, the teacher holds up a "HOME" card and all "human turtles" return to their home base.

7. To reinforce the sequence completed, the "human turtles" should repeat the three steps as a single procedure.

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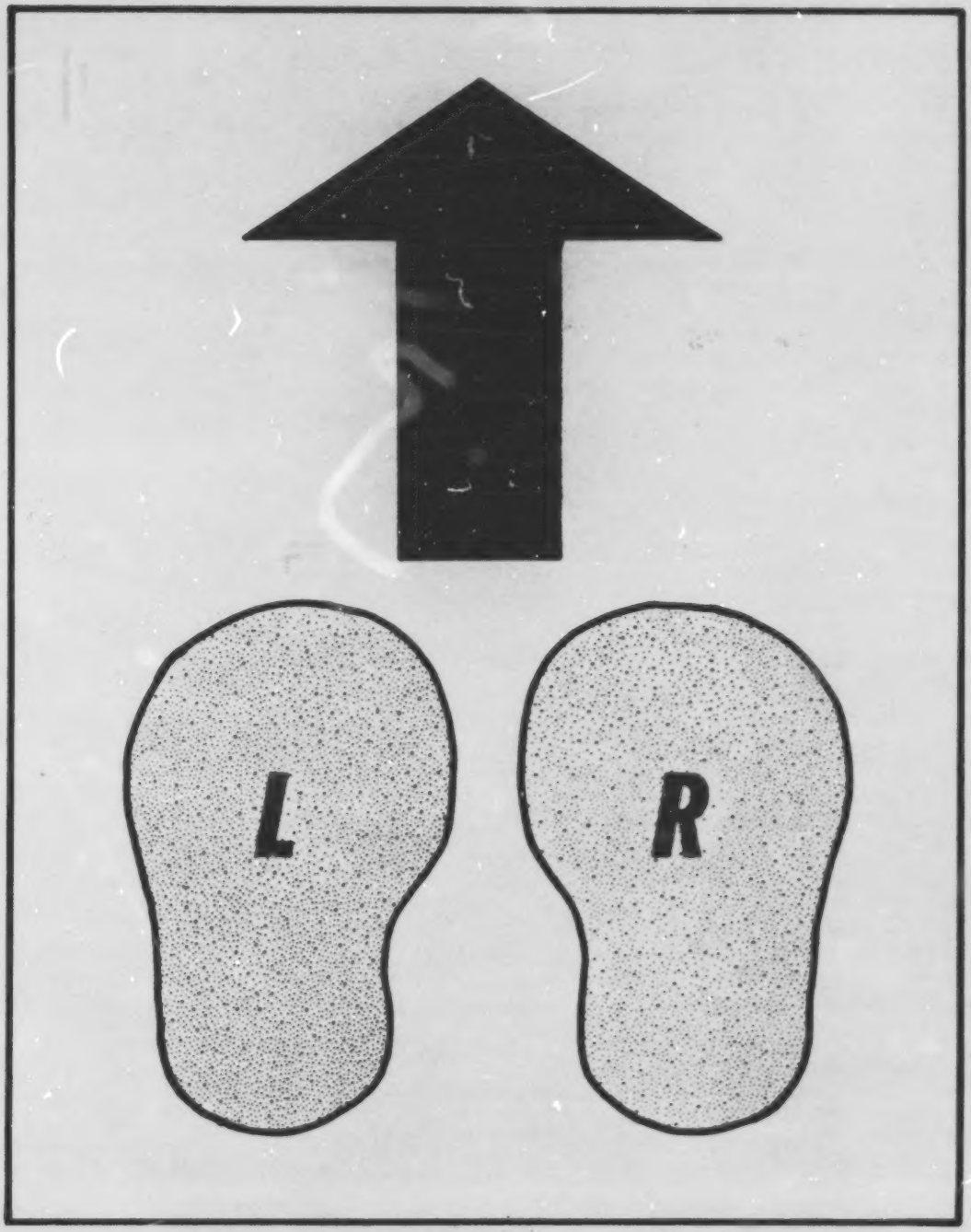
EXTENSIONS:

- Choose more than three students to be "SIMONS".
- If the classroom has a tiled floor, the students may use one tile as the unit for a "human turtle" step.
- "Human turtles" repeat the procedure without returning to home base.

IV-?-2
Level K
Logo
P.3 of 7



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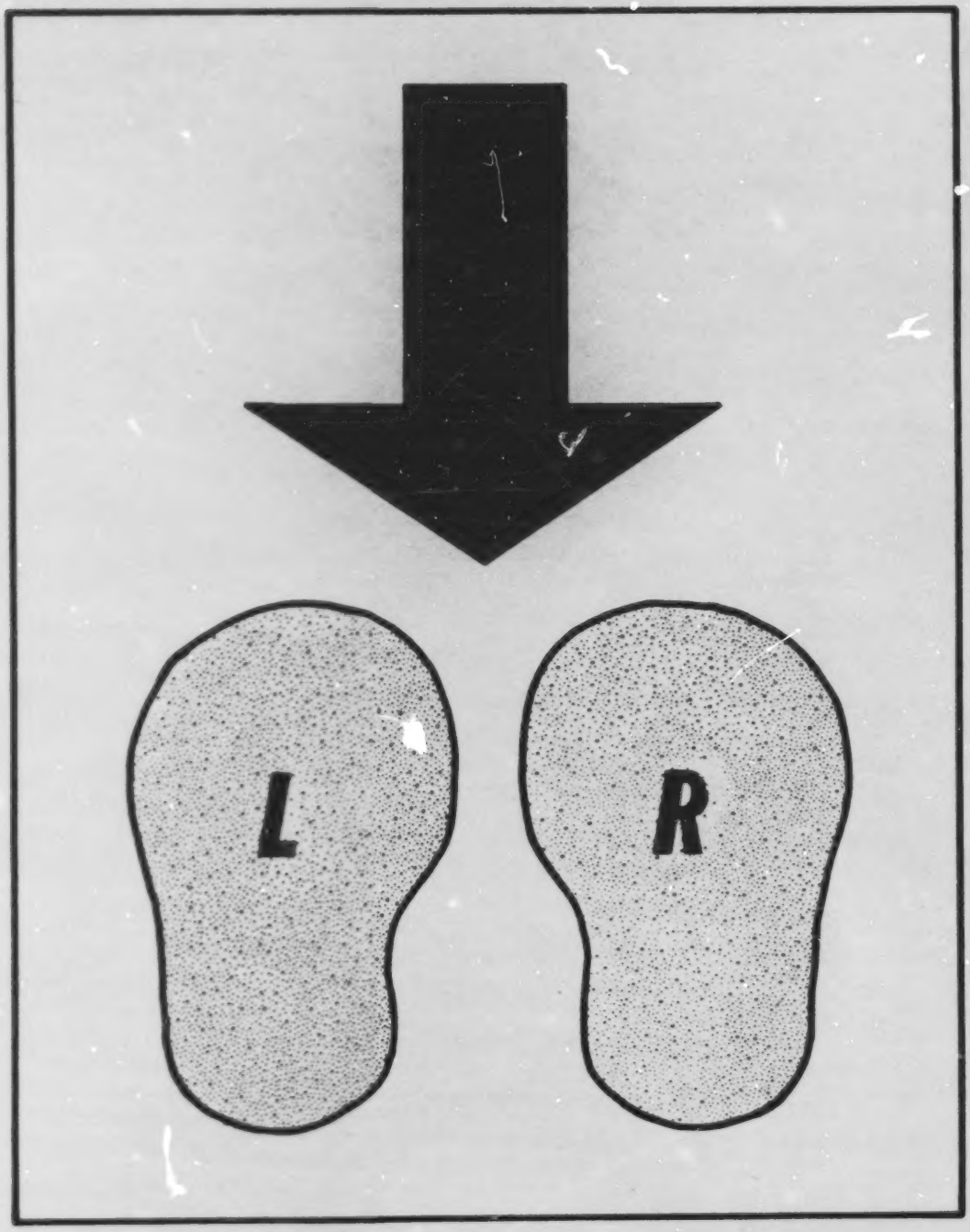
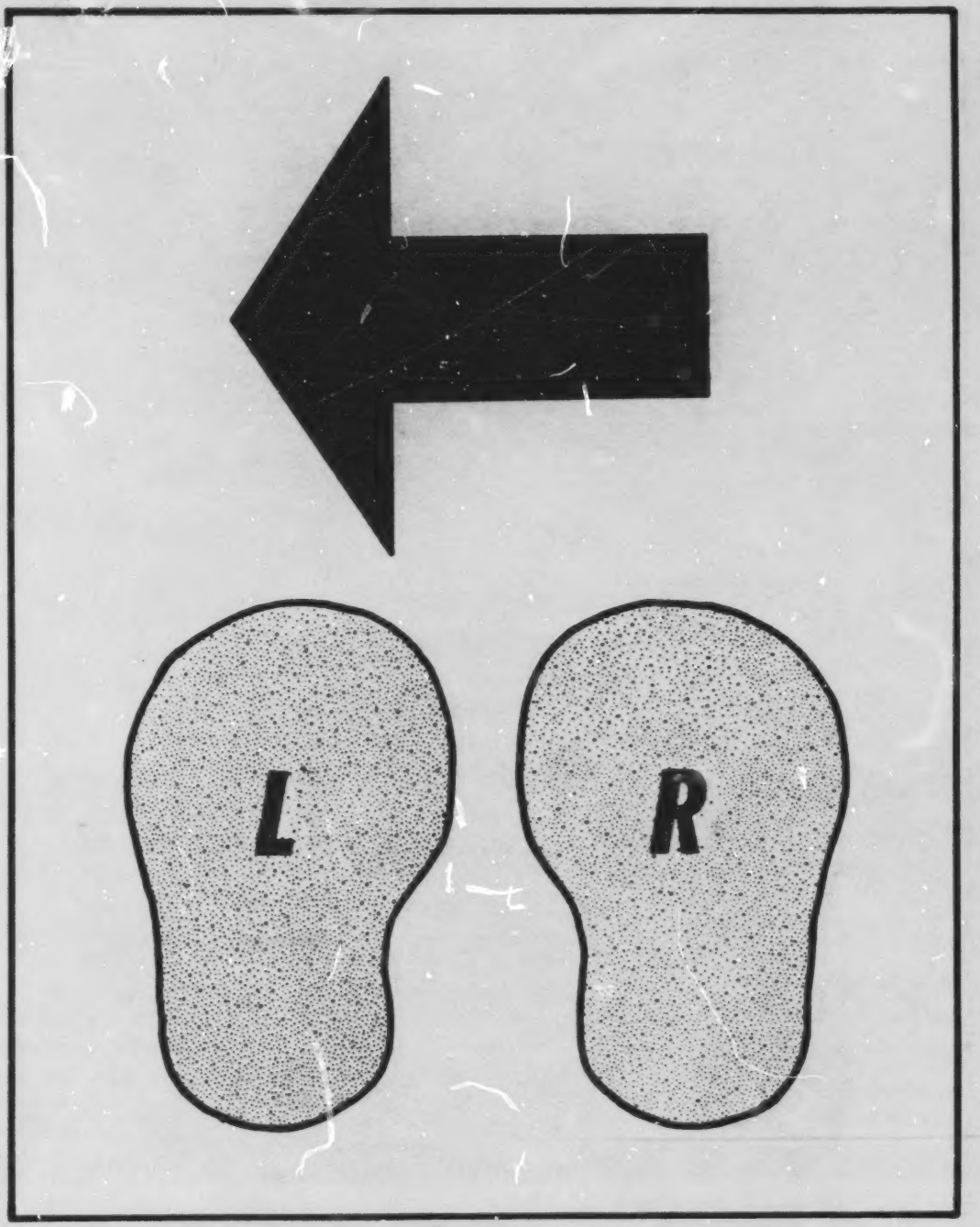
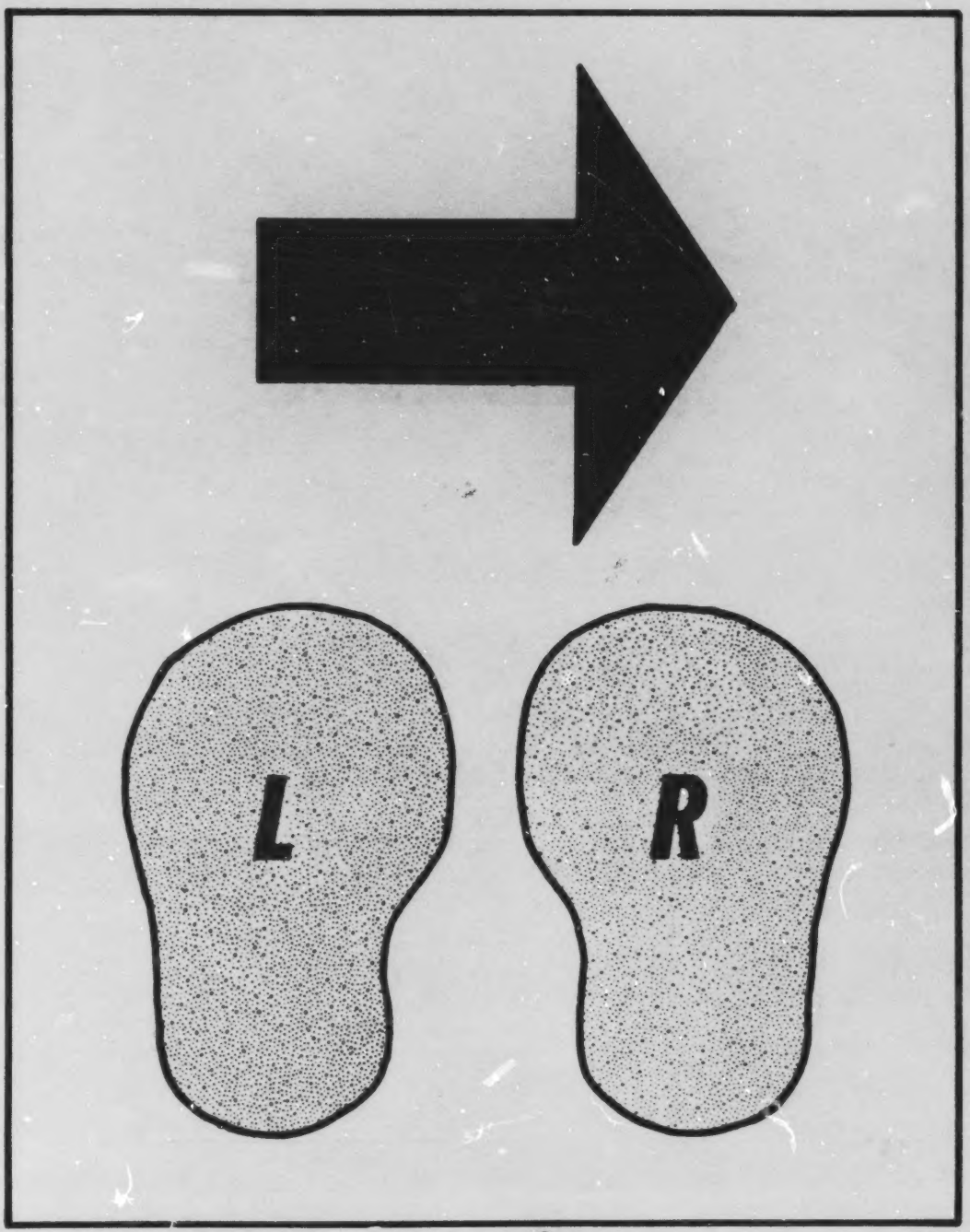
IV-2-2
Level K
Logo
P.4 of 7



162



163



164

IV-2-2
Level K
Logo
P.7 of 7

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Turtle Hat

IV-2-3
Level 1
Logo
P.1 of 2

DIRECTIONS:

1. Have each student draw the two sides of a turtle shell using dimensions no smaller than the sample given on the next page.

2. Encourage students to decorate their drawings and then to cut and attach the two sides to form a hat.

3. Attach a head to each hat using a single cup from an egg carton and a tail using construction paper or pipe cleaners.

4. Have students wear the turtle hat while acting as the "human turtle" to emphasize the need to have the turtle facing in the direction of movement.

*The turtle hat may be used in Activity IV-2-4.

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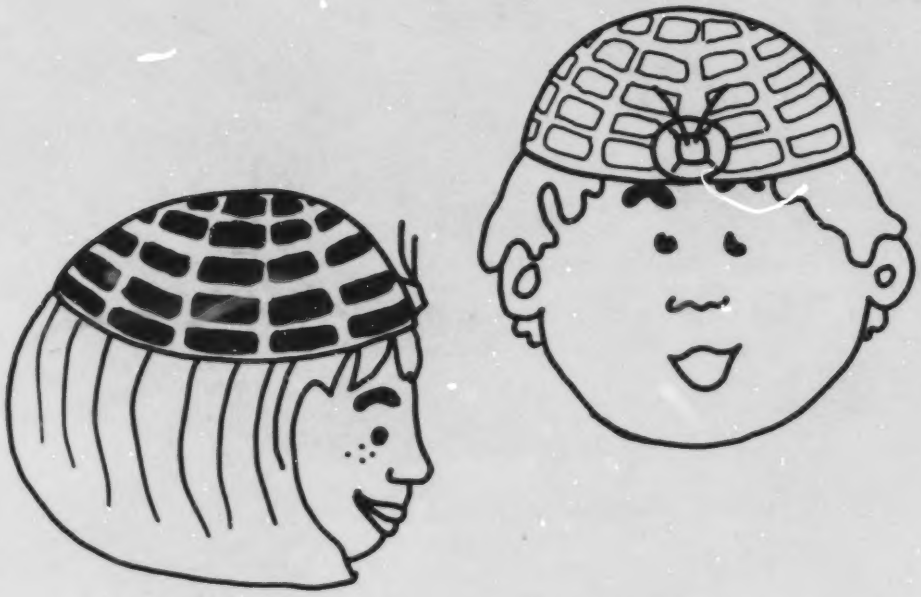

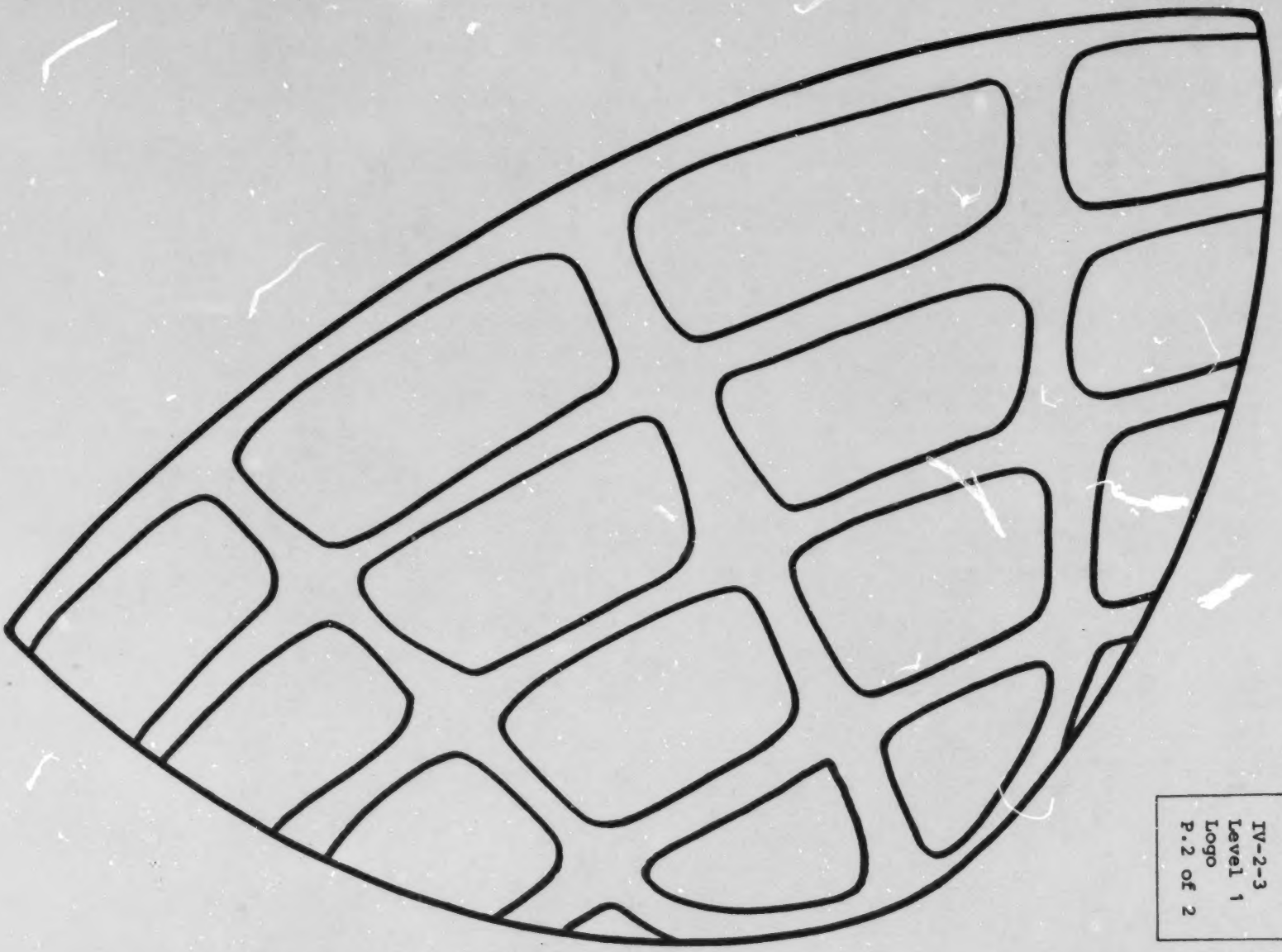

IV-2-3
Level 1
Logo
P.2 of 2

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Turtle Treasure

IV-2-4
Level 1
Logo
P.1 of 2

DIRECTIONS:

1. Have students construct a simple maze on the floor using masking tape.

2. Place construction paper rocks or lily pads at each corner of the maze.

3. One student wears the turtle hat and becomes the Pirate Turtle. The rest of the class group direct the pirate to the treasure using the commands:

   F forward 1 baby step
   B back 1 baby step
   R right 1 quarter turn
   L left 1 quarter turn

4. The teacher directs the activity by encouraging estimation involving distance and turning relative to the left hand and right hand of the Pirate Turtle.

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EXTENSIONS:

. Record the commands given to the Pirate Turtle.

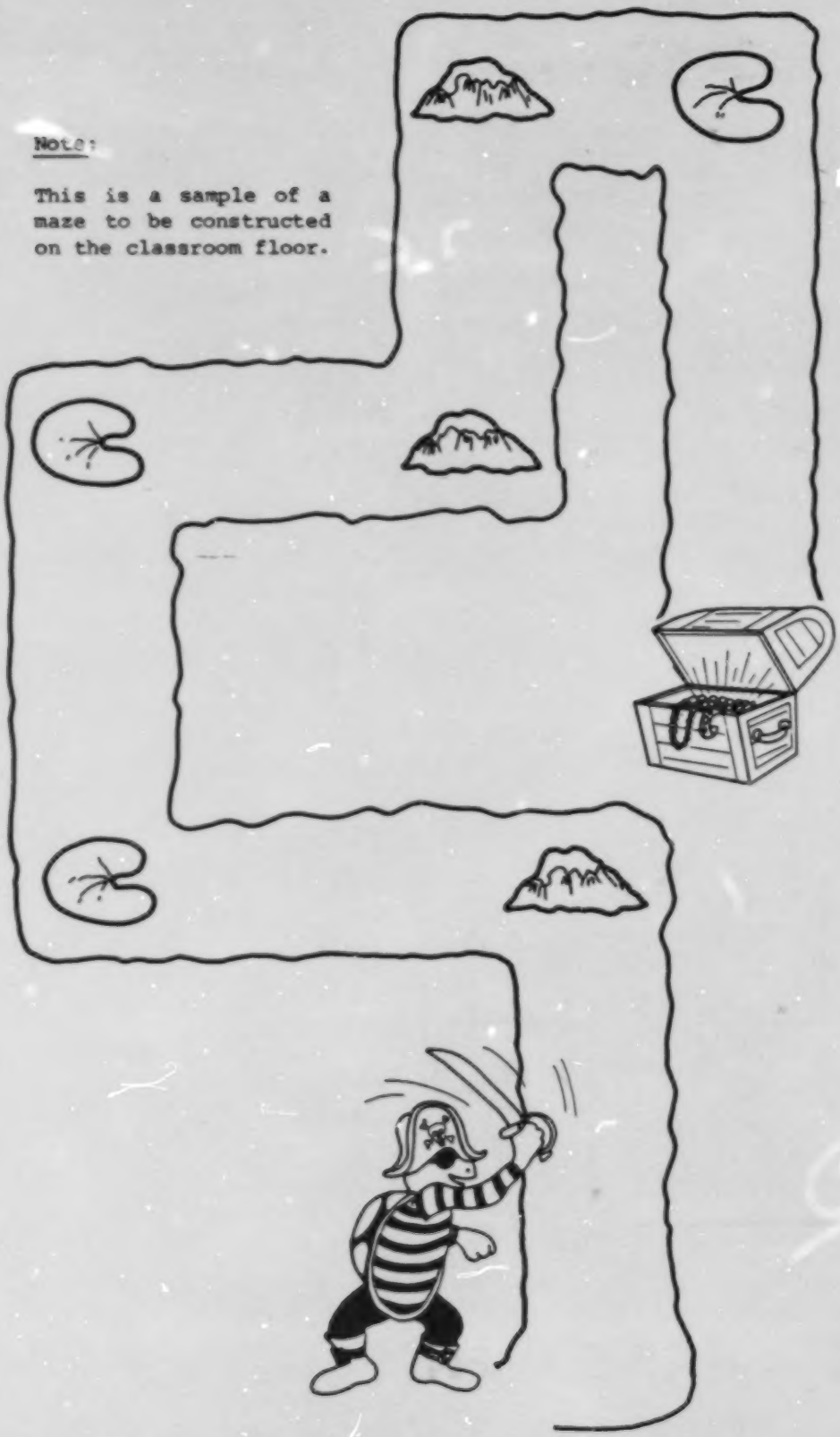
. Accummulate sequences of similar commands using a shorthand notation. For example write:

   FFFF as F 4
   L as L 1
   BB as B 2

IV-2-4
Level 1
Logo
P.2 of 2

Note:

This is a sample of a maze to be constructed on the classroom floor.



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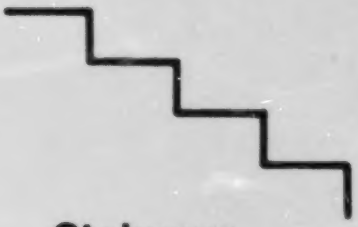
Planning Pictures

IV-2-5
Level 2
Logo
P.1 of 2

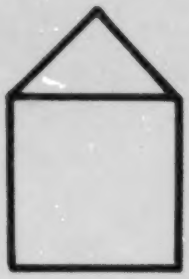
DIRECTIONS:

1. Students could work in pairs, in small groups or with the aid of a teacher/volunteer to complete this activity.

2. Each student or group either chooses a simple graphic design illustrated below or designs their own graphic.



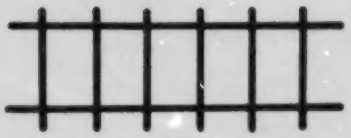
Staircase



House

Pine Tree

Ladder

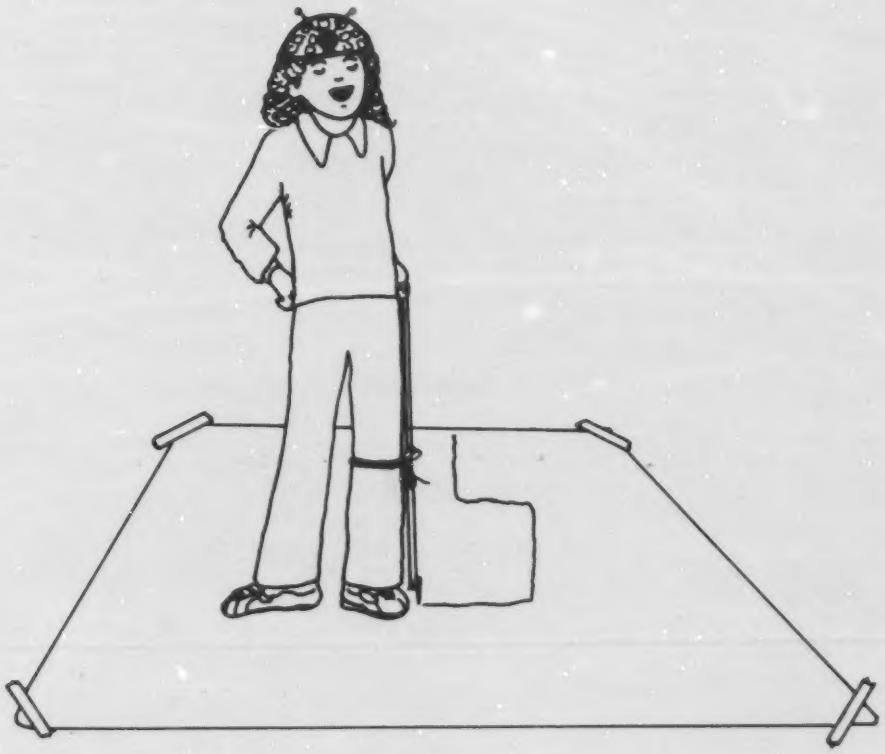


Railway Tracks

3. Each student or group plans the outline of their design by acting as a "human turtle". The "human turtle" stands on a large piece of paper which is taped to the floor and traces their design using a piece of coloured chalk taped to a metre stick.

4. The partner, the remainder of the group or the teacher should record the number of "human turtle" steps and the direction with the amount of turning.

5. Using the plan developed in #3 and #4, the student can reproduce the design on the screen.



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Human Turtle Travels

IV-2-6
Level 3
Logo/Teacher
Utility
P.1 of 4

In this activity, students write accurate directions using Logo vocabulary for the "human turtle" to follow in walking from a specified point in the classroom to a particular destination.

DIRECTIONS:

1. Students should brainstorm for some possible destinations within the classroom, the school, or the playground. Some suggested destinations for "human turtle" travel are:

From	To
the teacher's desk . . .	. . . the pencil sharpener
	. . . the wastepaper basket
the classroom door . . .	. . . the gym door
	. . . the water fountain
the front steps . . .	. . . the slide
	. . . the swings

2. A point of departure (FROM) and its destination (TO) are written on one side of an index card. Separate cards are made for each "human turtle" travel. Cover the destination.

FROM	TO
MY DESK	THE COMPUTER

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3. The other side of each index card is ruled as follows:

PREDICTION	CORRECTIONS	FINAL PROCEDURE

4. Students work in pairs or small groups to predict the steps which the "human turtle" must follow in order to reach the destination. The prediction is recorded in the first column of the index card.

PREDICTION	CORRECTIONS	FINAL PROCEDURE
FD 5 RT 90 FD 14 LT 90 FD 25		

5. Each pair or group of students must test their prediction by playing "human turtle" and physically walking through the steps.

6. Students de-bug or adjust their plan by writing their corrections in the second column of the index card.

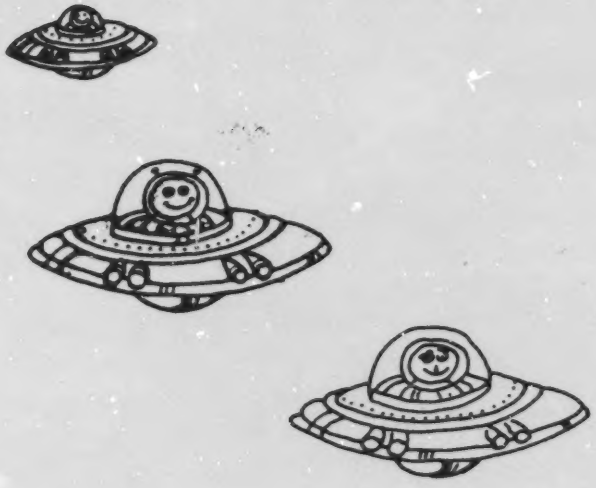
PREDICTION	CORRECTIONS	FINAL PROCEDURE
~~FD 5~~ RT 90 FD 14 ~~LT 90~~ FD 25	FD 7 RT 90	

7. Students write their final corrected procedure in the last column.

PREDICTION	CORRECTIONS	FINAL PROCEDURE
~~FD 5~~ RT 90 FD 14 ~~LT 90~~ FD 25	FD 7 RT 90	FD 7 RT 90 FD 14 RT 90 FD 25

8. All "debugged" cards are collected by the teacher. Each student pair draws randomly from the cards and, looking only at the FROM and the final procedure, predicts what the destination is.

9. Student pairs become "human turtles" to verify their prediction by walking through the steps in the final procedure. When the pair has reached the destination they may take the cover off TO on the front of the card in order to reveal the intended destination.



TURTLE ROBOTS

DIRECTIONS:

After students have experienced being a "human turtle" the next step in the development of Logo is to transfer the knowledge of human movement to that of a robotic device, such as Big Trak, Turtle Tot or Tasman Turtle.

Big Trak Robot:

Using Big Trak students should be encouraged to explore the range of its movements. Teachers should refer to the Operator's Manual that comes with Big Trak. Teachers may wish to make a cloth or paper cover for Big Trak to make it appear more turtle-like.

Robot Turtle (Turtle Tot or Tasman Turtle):

The teacher will need a version of Logo such as Apple Turtles, Apple Logo, Terrapin Logo, MIT Logo, Krell Logo, or others which support the turtle robot.

Teachers should create and save procedures similar to the following which allow students to control the robot using single keystrokes.

```
TO F
FORWARD 100
END

TO B
BACK 100
END

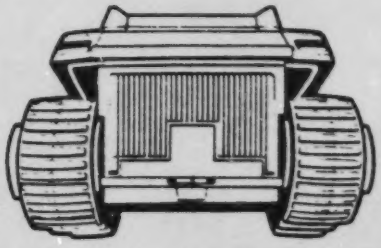
TO R
RIGHT 90
END

TO L
LEFT 90
END
```

Teachers may need to adjust the number 100 to match one body length of their robot turtle. Teachers should tape arrow symbols over the four keys:

F ↑ B ↓

R → L ←



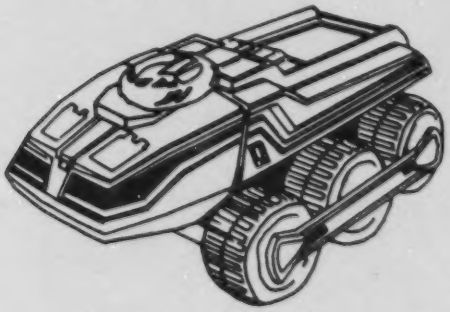
In order to make the robot turtle move, the student must press the RETURN key. Teachers may wish to attach a green "GO" symbol to the RETURN key.

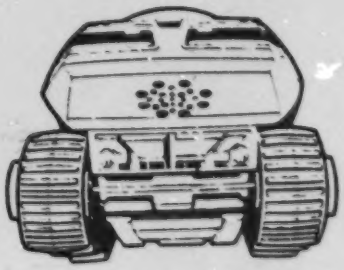
Using the robot turtle, students should be encouraged to explore its movement in comparison to their experience as a "human turtle."

EXTENSIONS:

1. After the students have had experience exploring with Big Trak or the robot turtle, the teacher may wish to have the students construct a "turtle community" similar to their own. The students could then move the robotic device along the streets of their "turtle community" to visit various locations.

2. Students may construct a maze using objects found in the classroom for the robotic devices to go around, under and through.





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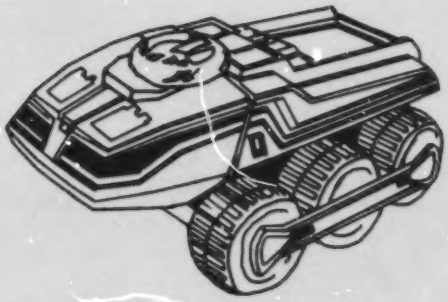
DISTRIBUTORS OF ROBOTIC DEVICES:

BIG TRAK

K-12 Micro Media
172 Broadway
Department CL
Woodcliffe Lake, NJ 07675
U.S.A.

Approximately $60.00 American



TASMAN TURTLE

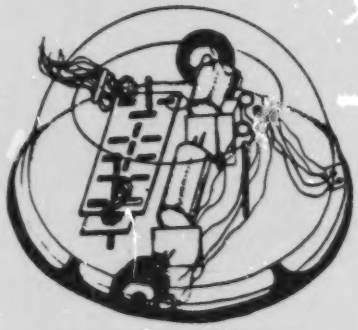
Harvard Associates Inc.
260 Beacon Street
Somerville, MA 02143
U.S.A.

Approximately $1000.00 American

TURTLE TOT

Harvard Associates Inc.
260 Beacon Street
Somerville, MA 02143
U.S.A.

Approximately $400.00 American



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Robot Attributes

IV-3-2
Level 2
LA/Ma/Sc
P.1 of 4

DIRECTIONS:

1. Duplicate the picture of the Master Robot and one set of the robot cards.
2. Cut out the robot cards. Laminate for durability.

SUGGESTED ACTIVITIES:

Find all the robots that are the same as the Master Robot.
Find the robots that are different.
Find the robots that have two differences.
Find the robots that have three differences.

FOLLOW-UP ACTIVITY:

Have students design their own Master Robot and robot cards. These may be based on real or fictional robots.

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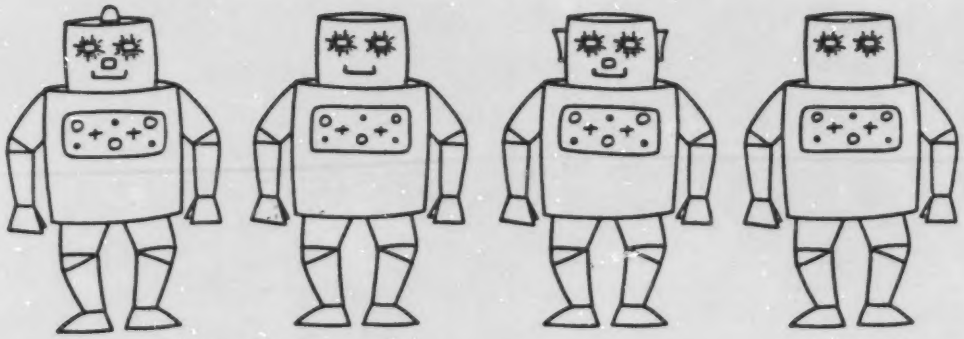
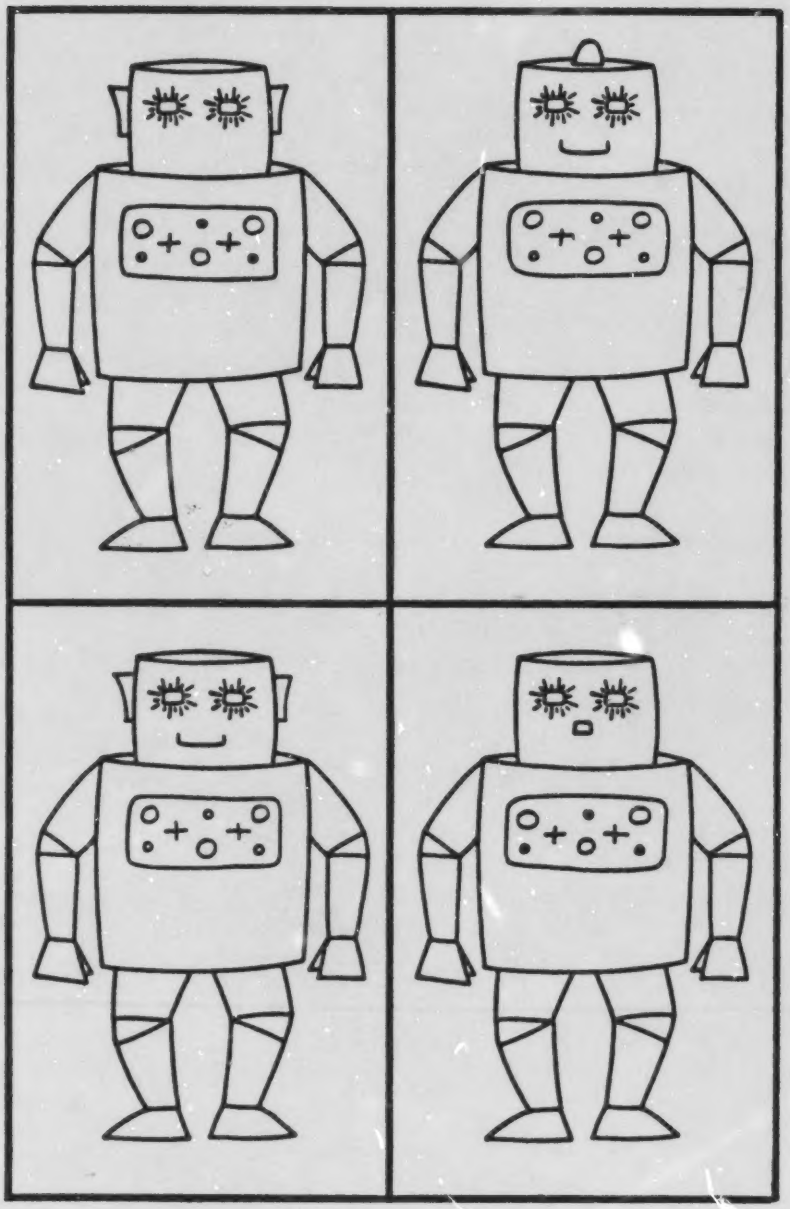


IV-3-2
Level 2
LA/Ma/Sc
P.2 of 4



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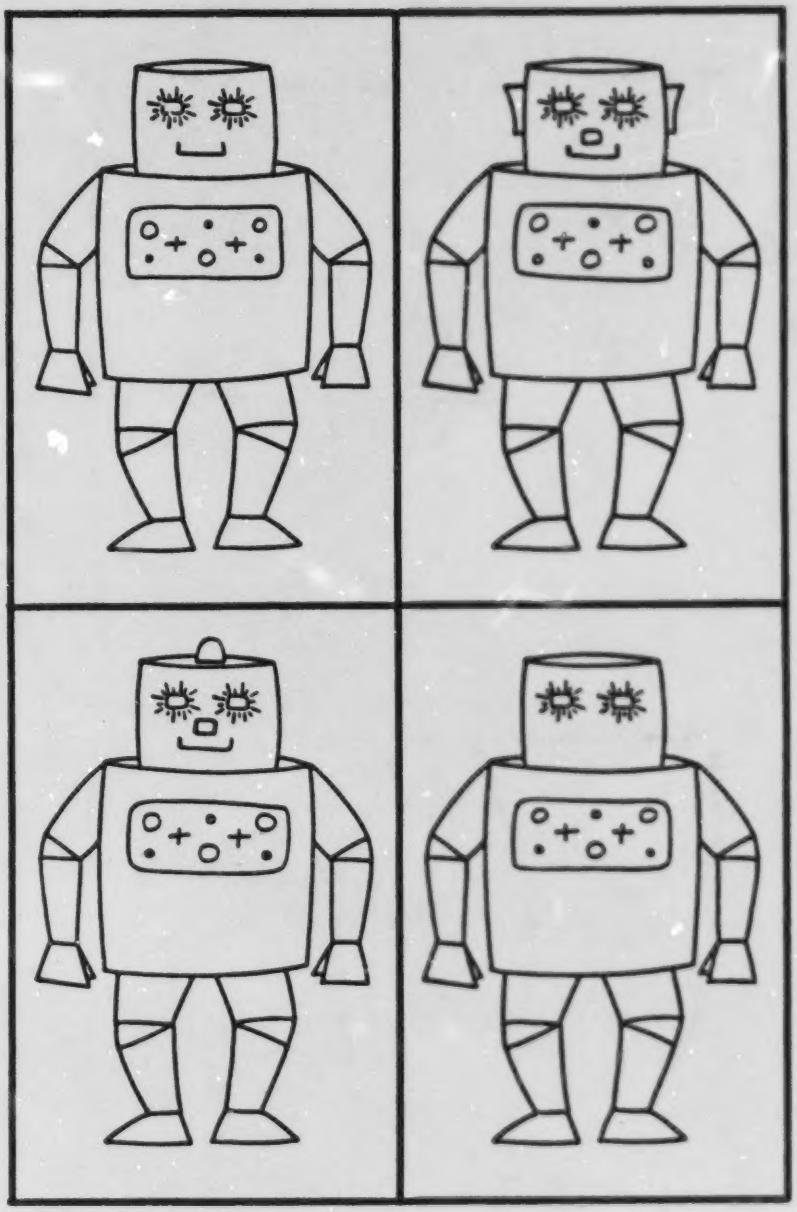
IV-3-2
Level 2
LA/Ma/Sc
P.3 of 4



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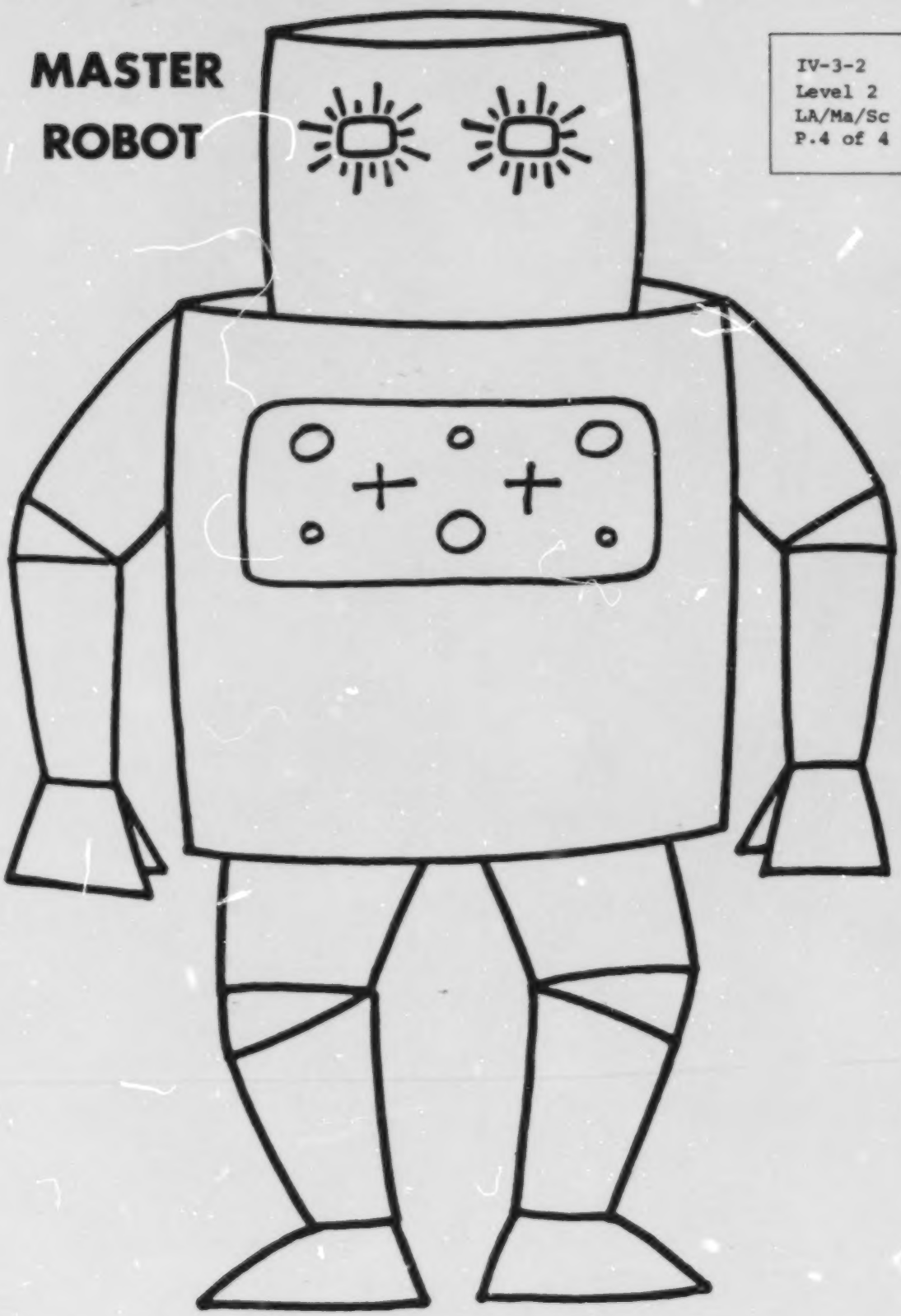
MASTER ROBOT

IV-3-2
Level 2
LA/Ma/Sc
P.4 of 4



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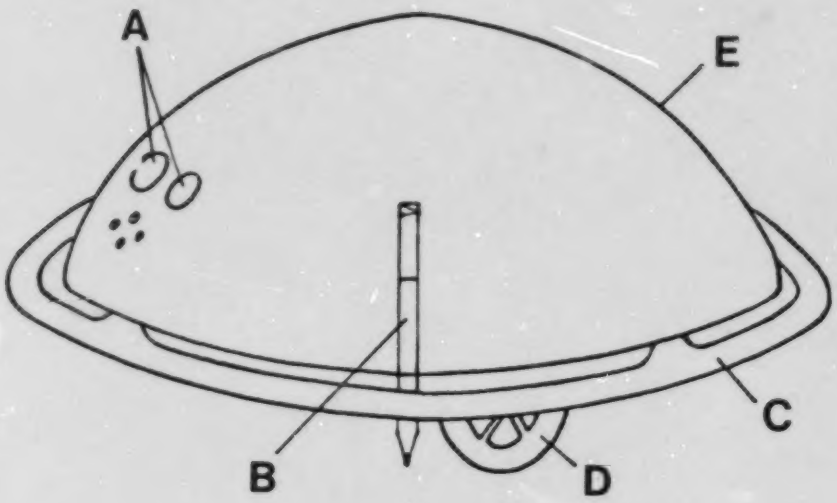
IV-3-3
Level 2
LA/Sc
P.1 of 2

Tasman Turtle

This is a sketch of a Tasman Turtle.



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Some parts you should know are:

eyes	plastic dome	sensor ring
pen	wheels	

Fill in the correct answer beside each letter below naming each part.

A. _____

B. _____

C. _____

D. _____

E. _____

The Tasman Turtle is a robot.

It moves only when we tell it to move.

We can tell it to do other things as well. What can it do?

Fill in the blanks below using these words:

back	horn
eyes	left
forward	right

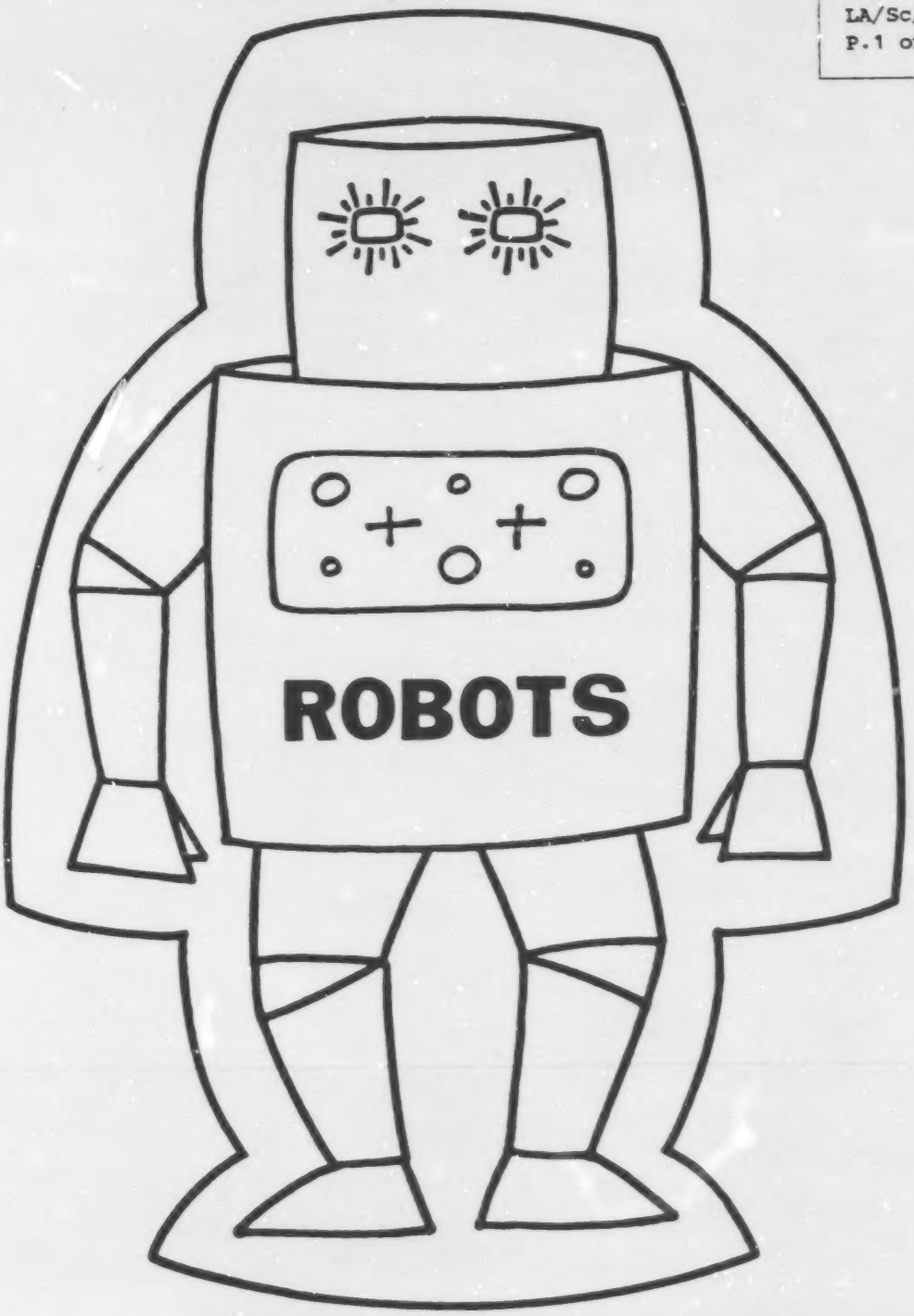
The Tasman Turtle can toot its _____.

It can wink its _____.

The Tasman Turtle can move _____ and _____.

It can turn _____ and _____.

IV-3-4
Level 2
LA/Sc/SS
P.1 of 6



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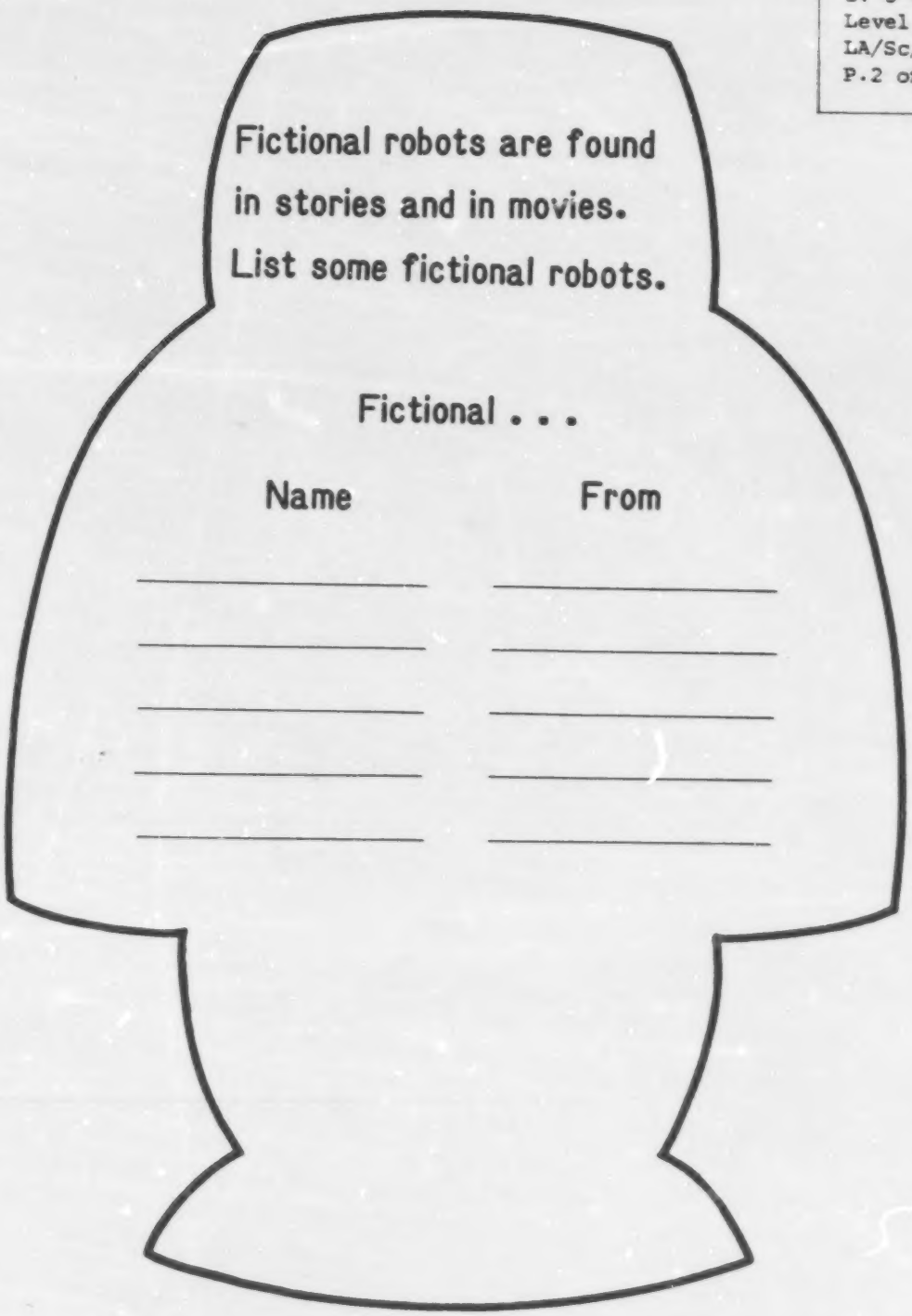
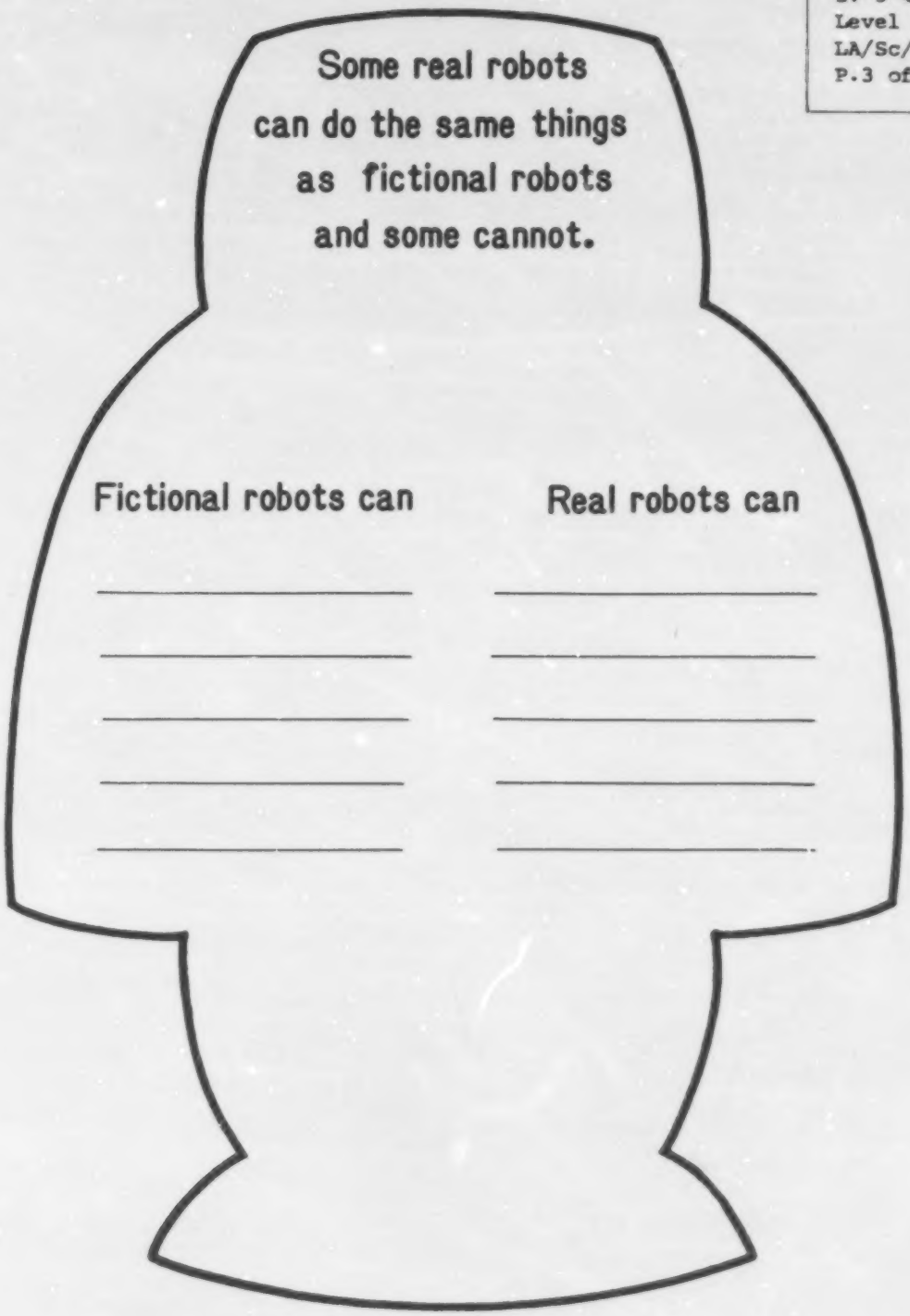


Fictional robots are found in stories and in movies. List some fictional robots.

Fictional . . .

Name	From
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____


Some real robots
can do the same things
as fictional robots
and some cannot.
Fictional robots can
Real robots can

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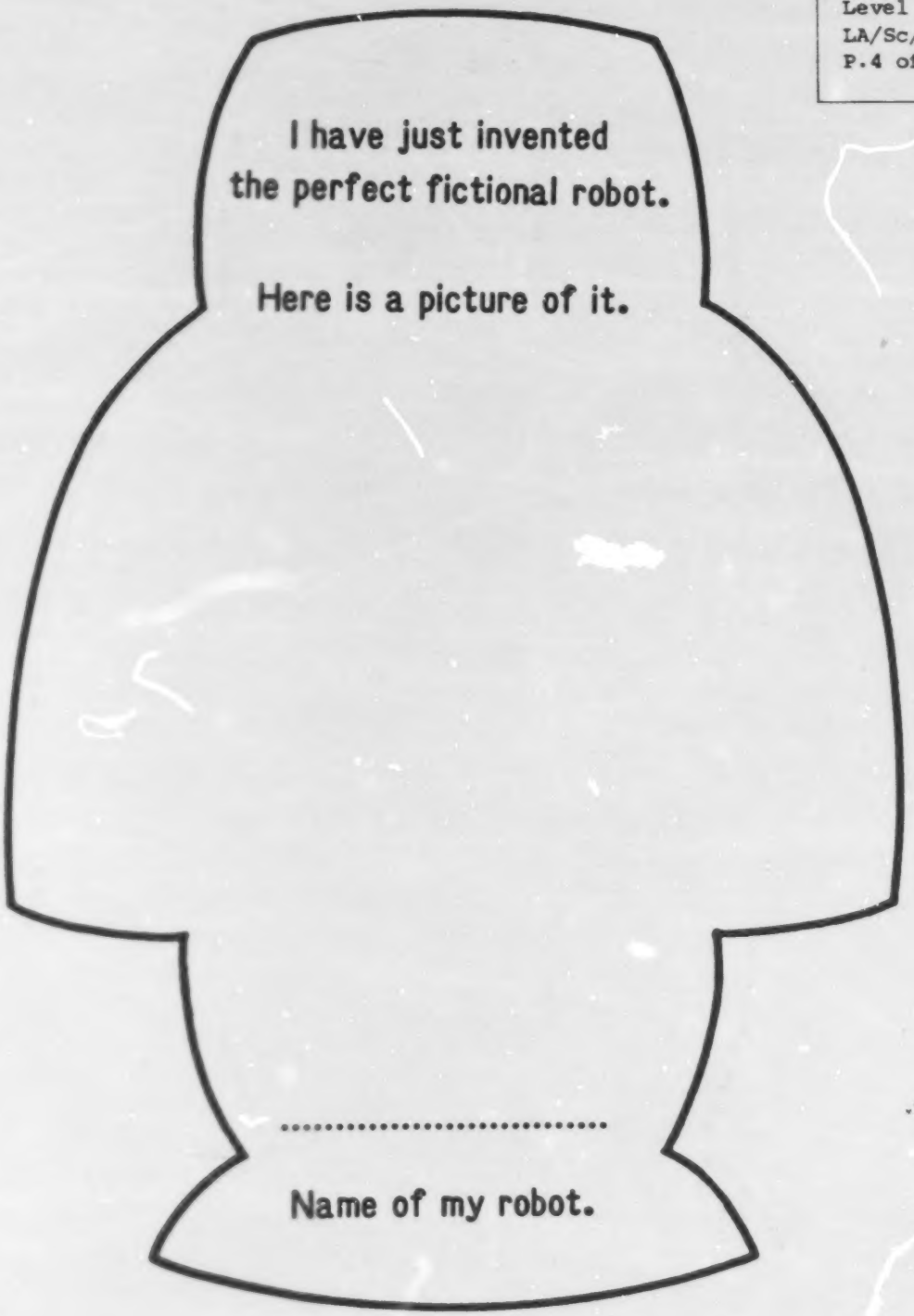
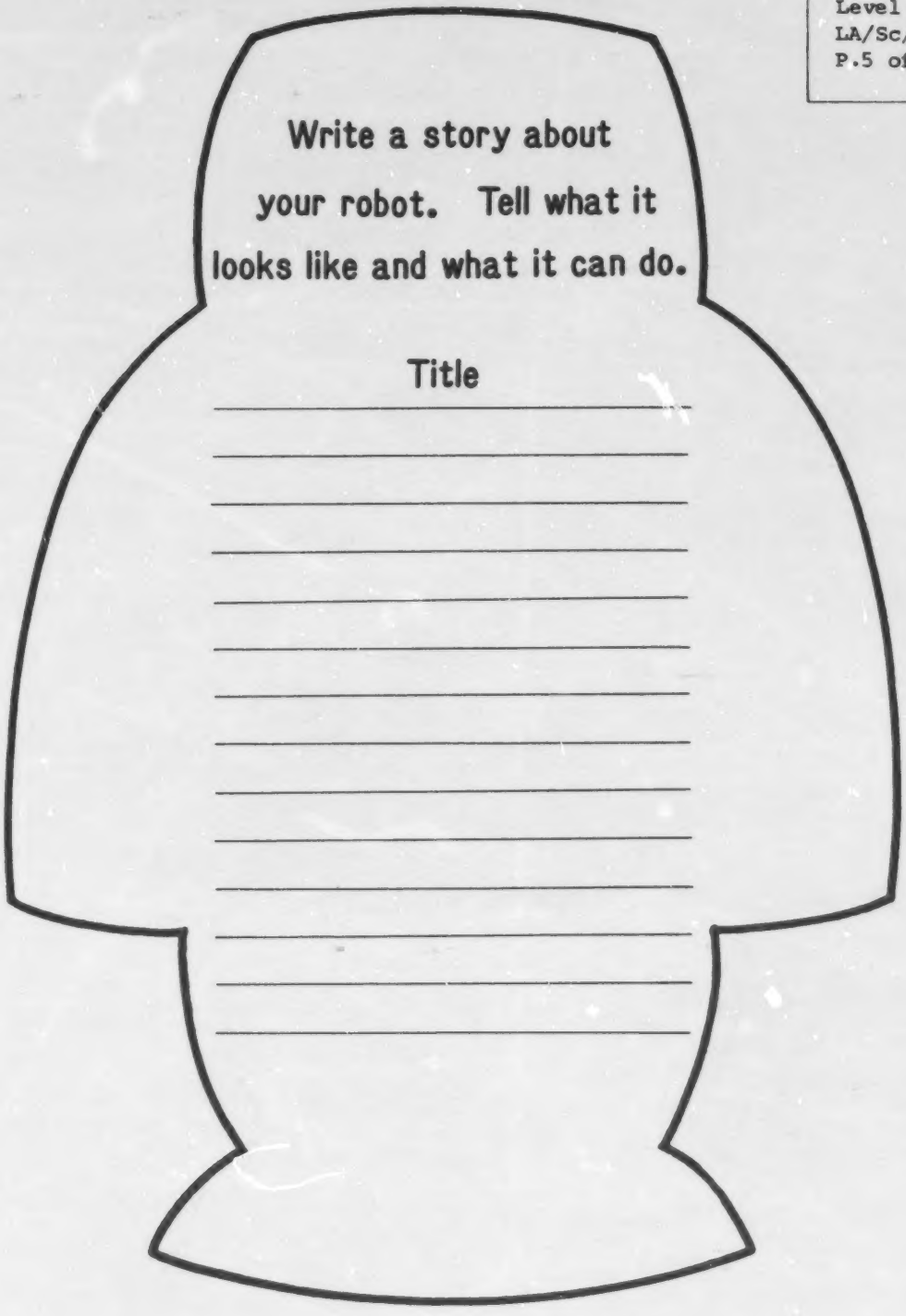
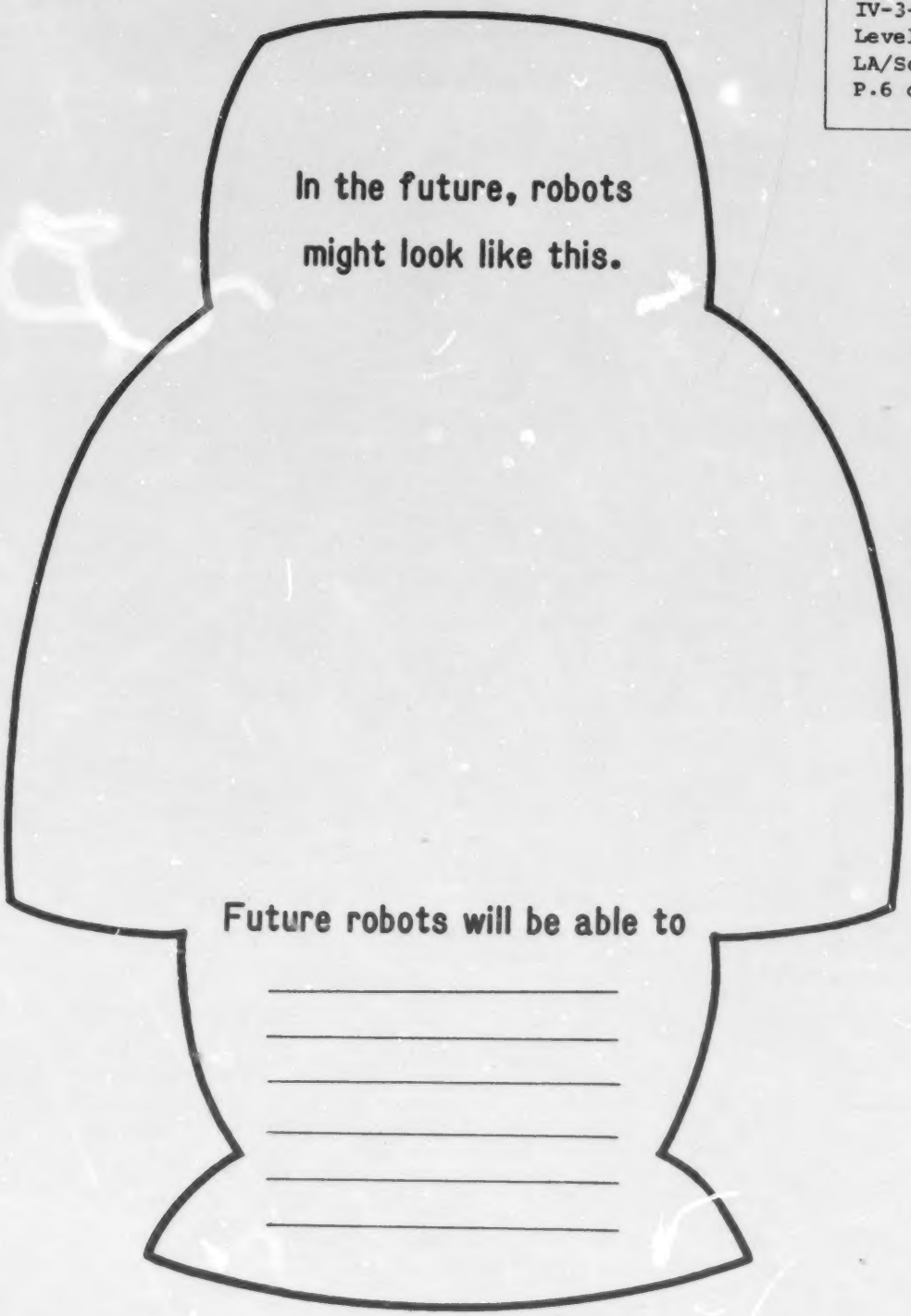

I have just invented
the perfect fictional robot.
Here is a picture of it.
.....
Name of my robot.


Write a story about your robot. Tell what it looks like and what it can do.
Title

In the future, robots might look like this.



Future robots will be able to

_____

_____

_____

_____

_____

_____

Turtle ABC's

IV-3-5
Level 2
Logo
P.1 of 1

This activity has been developed to allow the teacher to use a robotic device to assist students in the transition from playing a "human turtle" to using a "screen turtle" in immediate mode.

DIRECTIONS:

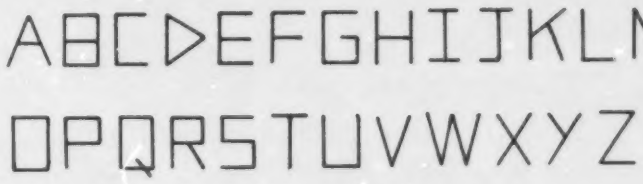
1. A robotic device, such as Big Trak, Turtle Tot or Tasman Turtle is needed for this activity. For further information about ordering a robotic device refer to Activity IV-3-1.

2. Attach a pen or pencil to the robotic device so that it can leave a visible trail on a large piece of paper.

SUGGESTED ACTIVITY:

This activity involves using a robotic device to draw selected block letters from the alphabet.

A sample block letter alphabet is shown below.



Depending on the number of students working together, the teacher may select from the following:

- If students work individually, they could use the robot to draw their first and/or last initial(s).

- If the students work in a small group, they could use the robot to outline the letters of a theme word currently being used in the classroom.

- If the students work as a class, each student could be given a letter of the alphabet to outline. When all the letters are complete the class can assemble and display the entire alphabet.

The Pond

IV-4-1
Level 1
Logo/Sc
P.1 of 1

It is recommended that the teacher integrate this activity with the Grade 1 Science curriculum in the area of Interdependency and Interaction Among Organisms - Living and Non-Living Objects.

DIRECTIONS:

1. The teacher should introduce the concept of an ecosystem centered around a pond. The students should brainstorm for the elements of the ecosystem and categorize them as living and non-living. Some possible responses may be:

living	non-living
bullrushes	rocks
lily pads	water
fish	beaver lodge
dragonflies	turtle home

2. Using concrete materials, the students should construct a model of an element of their choice from either the living or non-living category of the ecosystem. The student-constructed models should then be placed in or near the pond. A "turtle home" should be constructed as a starting point for the activity.

3. Each student can then make a "concrete turtle" from plasticine, play dough, or other modelling clay to use at the pond.

4. The teacher may then conduct a directed activity at the pond with small groups of students. Each student should have an opportunity to move his/her "concrete turtle" through the pond environment using only Forward, Back, Left and Right commands. At this time, turns should be restricted to 90 degrees to correlate with the turns programmed for the "screen turtle" in Single Keystroke Logo. One "concrete turtle" step should equal one body length of the "concrete turtle". The teacher should encourage only Logo vocabulary when discussing "concrete turtle" movements.

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Doodling TURTLES

DIRECTIONS:

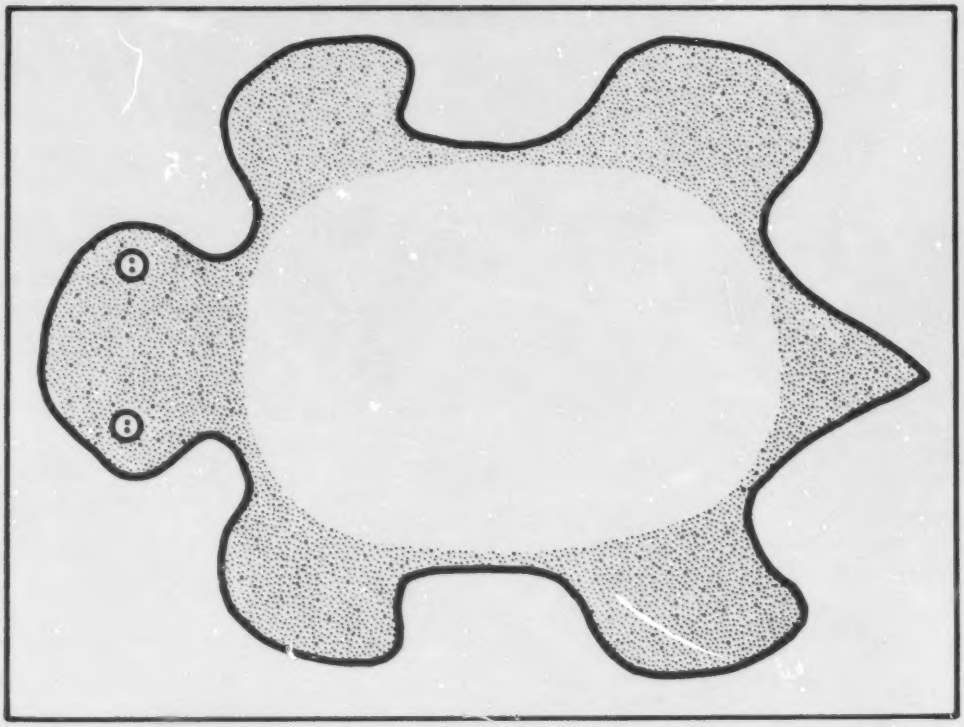
1. When beginning to use a version of Single-Keystroke Logo, introduce students to the keystrokes a few at a time. Allow students hands-on experience between exposures. This hands-on experience should be in the form of free exploration.

2. A suggested sequence is:

First Exposure	Forward	Right	Clear Screen
Second Exposure	Forward	Left	
Third Exposure	Forward	Right	Left
Fourth Exposure	Back	Right	Left
Fifth Exposure	Introduce other primitives which may be available or defined for the version of Logo available in the school (See Activity IV-5-2).		

3. In order for students to work independently at a learning centre, the teacher may wish to prepare activity cards. See sample on the next page. It is suggested that these cards guide the student through two types of activities:

   . a sample for the student to use to create a specific shape,
   . an opportunity for students to create their own shape(s).



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SUGGESTED ACTIVITIES:

The teacher may have to modify these suggestions to be compatible with the Single-Keystroke Logo being used.

First Exposure:

1. (Clear the screen)
   Press F F F F
   R F F
   R F F
   R F F

2. (Clear the screen)
   Make a design.

Fourth Exposure:

1. (Clear the screen)
   Press F R F
   B L F
   L B

2. (Clear the screen)
   Make a shape or letter.

Creating Doodling Turtles

IV-5-2
Level 1
Logo/Teacher Utility
P.1 of 5

DIRECTIONS:

Using the particular version of Logo or Logo-like language available in the school the teacher can create and save the following Logo procedures to produce their own "DOODLING TURTLES".

PROCEDURE	SYMBOL	PROCEDURE	SYMBOL
TO F FORWARD 10 END	F	TO B BACK 10 END	B
TO R RIGHT 30 END	R	TO L LEFT 30 END	L
TO C * CLEAR END	C	TO H HOME END	H

*Check to see if your Logo uses CLEARSCREEN, CS, or some other abbreviation.

The teacher should tape large symbols on these six keys and a green sticker on the RETURN key. The microcomputer and "Doodling Turtles" can be placed in a learning centre. Students can explore freely or can choose activity cards from those placed in the learning centre. Refer to Activity IV-5-1.

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The teacher can add some of the following procedures to enrich the doodling environment at the learning centre. Appropriate symbols should be taped on the keys as illustrated on page 3 of this activity.

PROCEDURE	SYMBOL
TO Z PENUP END	
TO X PENDOWN END	
TO Q LEFT 90 REPEAT 45 [FD 1 RT 8] RIGHT 90 END	
TO W LEFT 90 REPEAT 60 [FD 1 RT 6] RIGHT 90 END	
TO E LEFT 90 REPEAT 90 [FD 1 RT 4] RIGHT 90 END	

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PROCEDURE

SYMBOL

```
TO A
RIGHT 30
REPEAT 3 [FD 20 RT 120]
LEFT 30
END
```

```
TO S
RIGHT 30
REPEAT 3 [FD 30 RT 120]
LEFT 30
END
```

```
TO D
RIGHT 30
REPEAT 3 [FD 40 RT 120]
LEFT 30
END
```

```
TO T
REPEAT 4 [FD 20  RT 90]
END
```

```
TO Y
REPEAT 4 [FD 30 RT 90]
END
```

```
TO V
REPEAT 4 [FD 40 RT 90]
END
```

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PROCEDURE

SYMBOL

```
TO I
REPEAT 2 [FD 40 RT 90 FD 20 RT 90]
END
```

```
TO O
REPEAT 2 [FD 60 RT 90 FD 20 RT 90]
END
```

```
TO P
REPEAT 2 [FD 30 RT 90 FD 60 RT 90]
END
```

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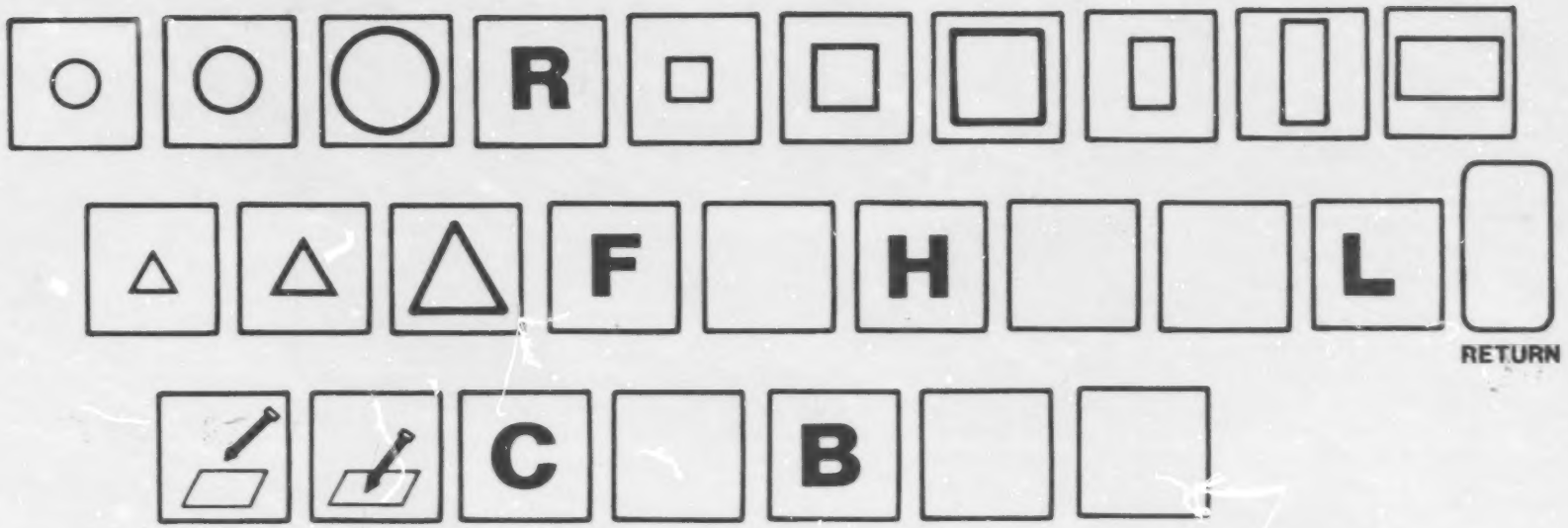
Teachers may wish to create their own shapes in various sizes and to redefine the background with new symbols. Extensions may include a key for putting on the eraser or for changing the background or pen colours.



IV-5-2
Level 1
Logo/Teacher
Utility
P.5 of 5

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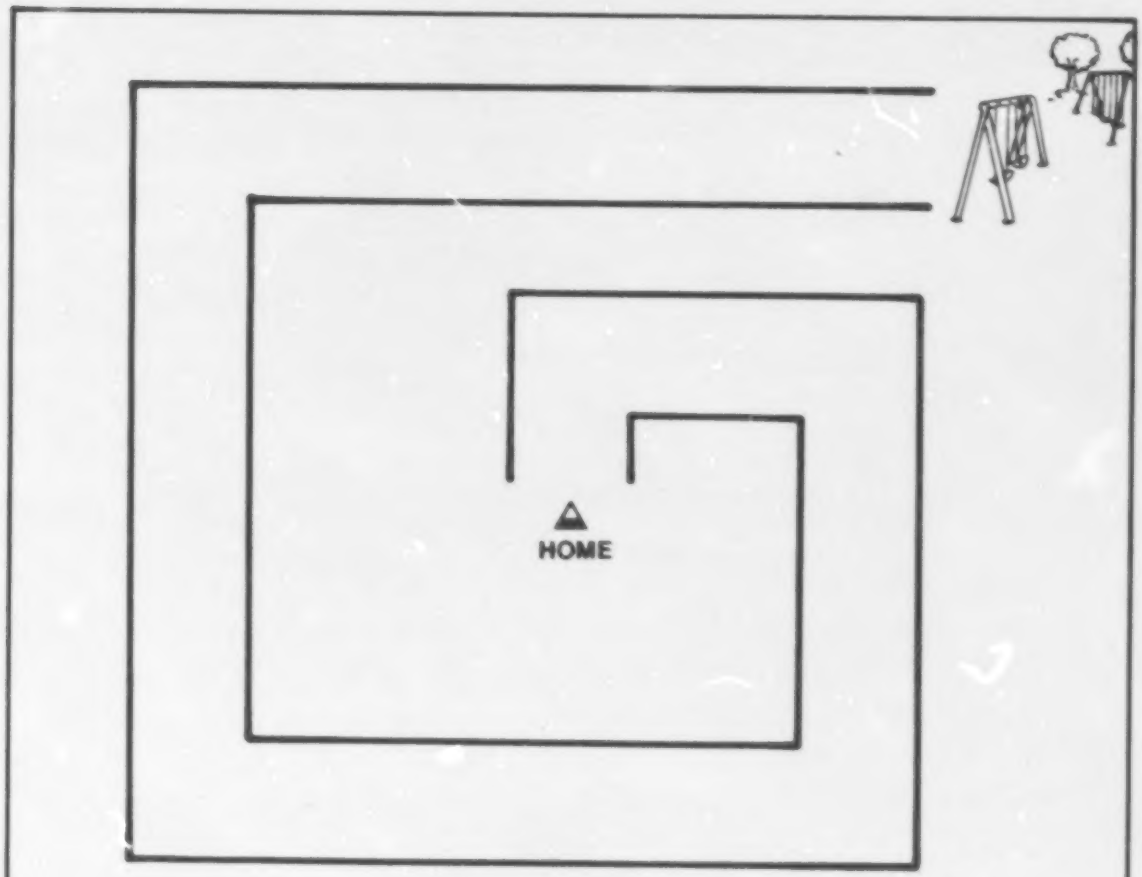
A-Maze-ing Turtles

IV-6-1
Level 2
Ma/Logo/
Teacher
Utility
P.1 of 2

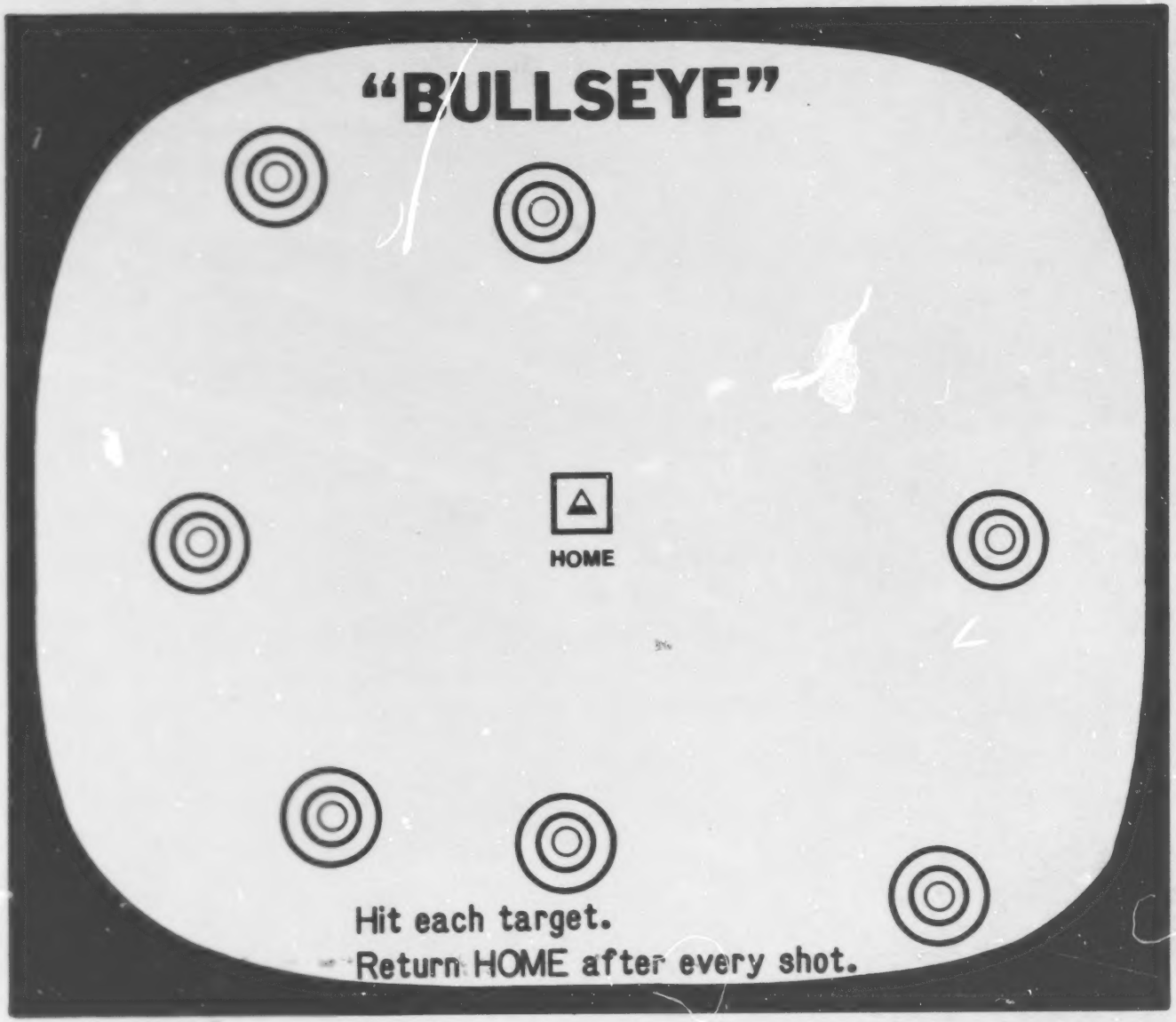
DIRECTIONS:

Prepare transparencies of the mazes provided. Place a transparency over the monitor screen. Students should follow the directions on each maze.



Take the turtle to the playground.

200



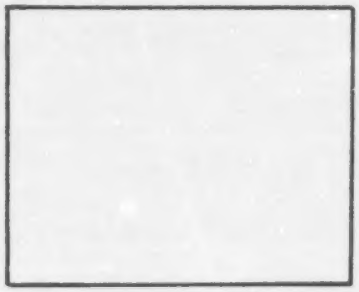
IV-6-1
Level 2
Ma/Logo/
Teacher
Utility
P.2 of 2

Designer Turtles

IV-7-1
Level 3
Logo
P.1 of 1

DIRECTIONS:

1. Draw a simple design in the box.
2. Write the steps needed to create your design on the lines below the box.
3. Test the steps on the computer to see if they create your design. If the steps do not create your design revise them.



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PLAN

REVISED PLAN

Microchips Around Us

V-1-1
Levels 2,3
LA/SS/Teacher
Utilitly
P.1 of 1

DIRECTIONS:

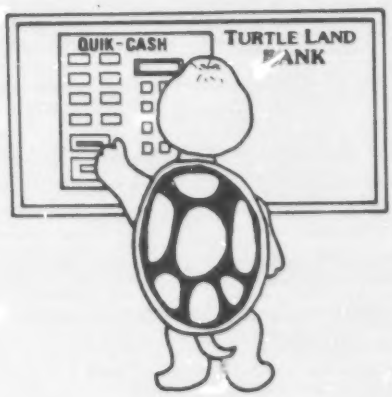
1. Encourage the students to bring pictures from magazines, catalogues or posters showing devices that use microchips.

2. Prepare a separate chart for each category:

   Microchips in the Home
   Microchips in the School
   Microchips in the Community

   If a device belongs in more than one category, discuss which category it would fit best and the reasons for the choice.

3. Have students mount each of their pictures on the appropriate chart. Print the name of the device under each picture.



Community

Home

School

A COMPUTER PLAY IN 3 "BYTES"

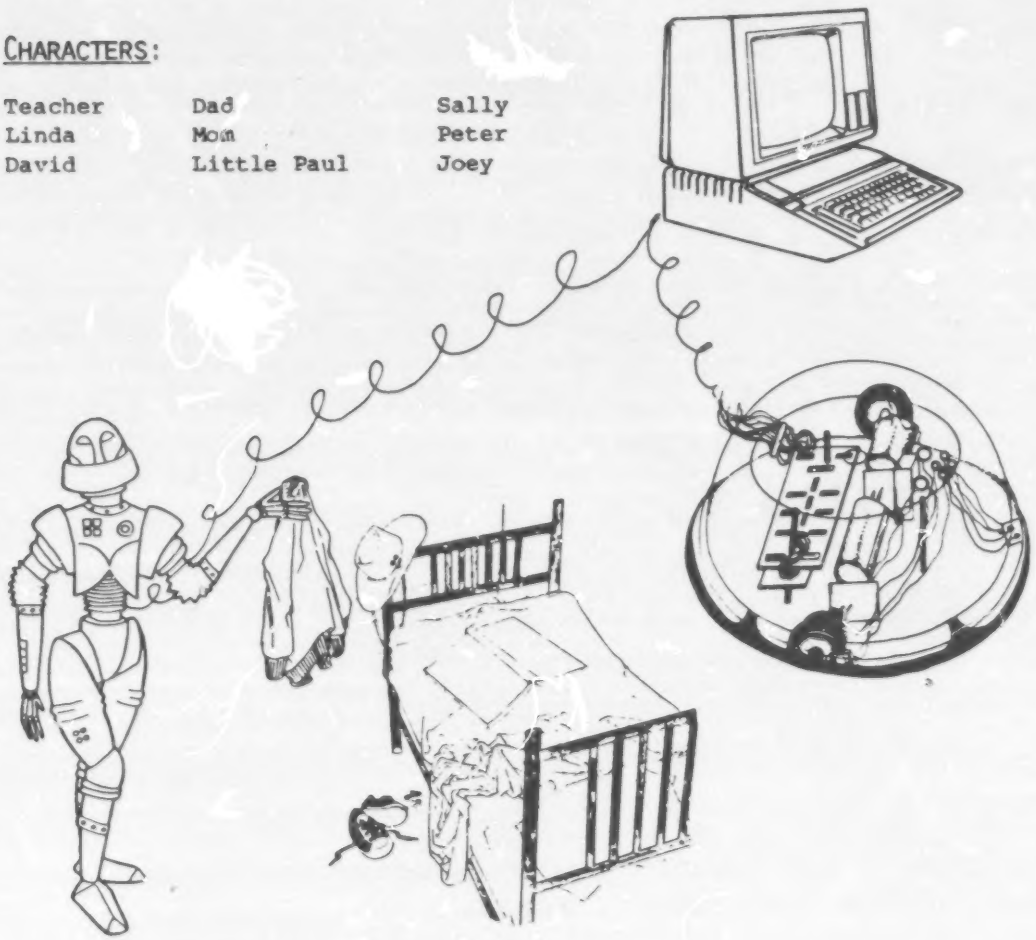
V-2-1
Levels 2,3
LA/SS
P.1 of 4

DIRECTIONS:

This play is designed to introduce students to some computer uses. It is intended that all students in the class bring information and participate in the play. Their input is required at the end of the play when the teacher says, "Very good point. Anyone else?" At this point, the classroom teacher may choose to lead the discussion or to allow the Acting Teacher to continue.

CHARACTERS:

Teacher	Dad	Sally
Linda	Mom	Peter
David	Little Paul	Joey



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Act 1

The setting is a clasroom. Students are seated in desks. A teacher is at the front of the room.

Teacher: I have a big surprise for you boys and girls.

Children: (Act excited.)

Teacher: Settle down and listen closely. Our school has just purchased 3 microcomputers. They will be here next week.

Children: (Look puzzled.)

Teacher: Well boys and girls, you don't seem very excited.

Linda: We were hoping our surprise was a day off.

David: Computers mean nothing to us!

Teacher: Let's see if David is right. Who knows anything about computers?

Sally: They're scary!

Peter: Huge companies buy computers - not schools.

Joey: Computers will change my life

Teacher: (Excited!) How is that Joey?

Joey: I heard Miss Wilson, my Social Studies teacher, say, "When computers come into this school, I move out."

Children: (All cheer.)

Teacher: (Restores order.)
Has anyone here heard of computers being used in schools before?

Linda: My brother's in university and he's taking a course called computer science.

Teacher: That's interesting Linda, has he told you about anything he does?

Linda: No - not my brother.

Teacher: Your assignment for tomorrow is to go home and ask your family what they know about computers and we'll discuss this some more tomorrow.

Now, all get ready to go home.

ACT 2

Peter's family sitting around the dinner table.

Peter: Dad, do you know anything about computers?

Dad: Like what Peter?

Peter: What are they used for?

Dad: Oh, big companies do all their bookkeeping on them. Why do you ask?

Peter: Mrs. Smith told us that we'll be getting computers into our school.

Dad: That's crazy - more wasting of taxpayers' money. What are they going to do with them?

Mom: Maybe it's not such a bad thing George. The other day when I went to the bank, the teller gave me a different kind of bank book. She said all their banking is done with computers now. Then, I went to the new grocery store that opened up, and the check out girl did nothing. She told me the computer was reading and recording the prices. Look at this sales slip.

Little Paul: I want a computer game for Christmas. "Donkey Kong" that's my favorite.

(Microwave beeps three times.)

Mom: That's the microwave. The soup is ready.
(Mom leaves.)

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Peter: Dad isn't our microwave oven just like a computer?

Dad: That's true. I never thought of that before.

(Mom returns and sits down.)

Dad: You know Alice - maybe it's a good idea that Peter will be exposed to computers. They seem to be creeping up all around us. Just imagine what the world will be like when Peter's our age.

ACT 3:

Classroom setting with students seated in desks.

Teacher: Well, boys and girls, who did their homework?

(All hands go up.)

Teacher: Well then, who would like to give us a report on what they learned about computers?

Peter: (Stands up.)
At first my Dad was against computers coming into the school. But when we discussed it, we found out computers are all around us. For example, in the banks, grocery stores, even T.V. games have computers in them.

Teacher: Very good point. Anyone else?

(At this point other students present their reports on what they learned about computers from school, home and other community resources.)

Teacher: Well boys and girls I see you all did a good job of your homework. Let's start spreading the good news around the school. And Joey, your job will be to convince Miss Wilson to stay here and learn about computers with us.

(Provided courtesy Evelyn Podolsky, Bertrun E. Glavin Elementary, River East School Division No. 9.)

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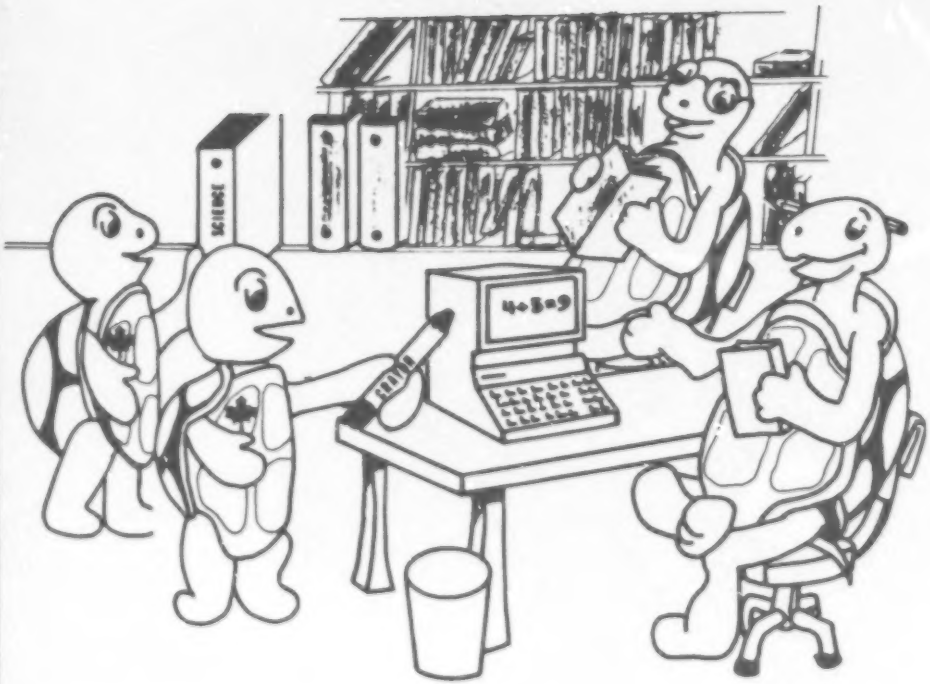
resource materials



MICROCOMPUTER COURSEWARE

The microcomputer chosen to support teaching and learning about computers in the primary classroom should be capable of running the following types of courseware:

1. Logo or Logo-like computer languages,
2. robotics-control software to support robotic devices such as the "Tasman Turtle" or "TurtleTot",
3. primary word processing software such as "Bank St. Writer", "Kidwriter", or "Magic Slate",
4. graphics-based courseware such as "Gertrude's Secrets" or "Koala Micro Illustrator" which allows input from devices such as joysticks, game paddles, or graphics tablets,
5. microcomputer simulations such as "Odell Woods" or "Factory",
6. early childhood experience-based software such as "Sticky Bear Numbers" or "Juggle's Rainbow",
7. educational gaming software such as "Bumble Plot",
8. problem-solving software such as "Moptown Parade" or "Memory: The First Step to Problem Solving",
9. drill-and-practice software such as "Music Theory", and
10. sound-generating software such as "Songwriter" or "Bank St. Music Writer".

Further information concerning educational courseware can be obtained by referring to the Directory of Educational Courseware Evaluations. This Manitoba Education publication contains alphabetical listings of evaluated courseware and of courseware suppliers as well as descriptive information on each item of courseware evaluated. The Directory may be borrowed from the Manitoba Education Library or the local school division office, or it can be purchased from the Manitoba Text Book Bureau.

PRINT MATERIALS

Print materials identified in this section were used and evaluated by K-3 Computer Awareness pilot teachers. The information is presented in two parts:

1. K-3 Computer Awareness Print Materials--An alphabetical listing of the print materials that the pilot teachers found most useful.

2. Description of K-3 Computer Awareness Print Materials--A brief annotation and identification of the strengths and weaknesses for each title.

Each title is coded to assist in identifying the supplier. Suppliers' codes and addresses are listed at the end of the Resource Materials section.

Teachers are advised that the list of print materials is not exhaustive and is representative of those materials found appropriate during the 1983-84 school year. Teachers should refer annually to the Manitoba Text Book Bureau Catalogue to obtain the latest information on recommended K-3 Computer Awareness print materials.

K-3 Computer Awareness Print Materials

Apple Logo in the Classroom. St. Paul: Minnesota Educational Computing Consortium, 1983. (MTBB).

Ball, Marion J., and Sylvia Charp. Be A Computer Literate. Morris Plains: Creative Computing Press, 1977. (AL)

Burnett, J. Dale. Logo: An Introduction. Morris Plains: Creative Computing Press, 1982. (AL)

Computer Services. Taming TuRtleS is "TUR"-rific. Winnipeg: Manitoba Department of Education, 1983. (MTBB)

----------. Training Your PET TURTLES. Winnipeg: Manitoba Department of Education, 1983. (MTBB)

Davis, Joan, and Joan Schwenker. Logo: Problem Solving for Primary. Spokane: Turtle Enterprise, 1983. (TUR)

D'Ignazio, Fred. The Computer Parade. Morris Plains: Creative Computing Press, 1983. (AL)

----------. Katie and the Computer. Morris Plains: Creative Computing Press, 1979. (AL)

Frank, Mark. The Prentice-Hall Concise Book of Computers. Scarborough: Prentice-Hall Canada, 1982. (PH)

Girard, Suzanne, and Kathlene Willing. The Primary Computer Dictionary. Cobalt: Highway Book Shop, 1983. (HB)

Papert, Seymour. Mindstorms: Children, Computers, and Powerful Ideas. New York: Basic Books, 1980. (FW)

Rice, Jean, and Sandy O'Connor. Computers Are Fun. Minneapolis: T. S. Denison, 1981. (MTBB)

----------. Computers Are Fun: Teachers Guide and Activity Book. Minneapolis: T. S. Denison, 1981. (MTBB)

Ryder, Joanne. Star Wars: C-3PO's Book About Robots. New York: Random House, 1983. (RH)

Spencer, Donald D. Computer Awareness Book. Ormond Beach: Camelot, 1982. (CAM)

----------. Exploring the World of Computers. Ormond Beach: Camelot, 1982. (CAM)

----------. Visual Masters for Teaching About Computers. Ormond Beach: Camelot, 1982. (CAM)

Thornburg, David D. Every Kid's First Book of Robots and Computers. Greensboro: Computer Books, 1982. (HRW)

Watt, Daniel. Learning With Logo. New York: McGraw-Hill, 1983. (MH)

Description of K-3 Computer Awareness Print Materials

Title: Apple Logo in the Classroom. St. Paul: Minnesota Educational Computing Consortium, 1983. (MTBB)

Annotation: This manual is necessary if students are using Apple Logo. It contains teacher notes and modules of student activities. The modules are designed with increasing difficulty.

Strengths
- lists materials needed, time allotments, directions for the teacher
- variety of sequenced activities from simple to complex

Weaknesses
- not well bound
- teacher needs "hands-on" experience

Title: Ball, Marion J., and Sylvia Charp. Be A Computer Literate. Morris Plains: Creative Computing Press, 1977. (AL)

Annotation: This book was recommended as a student and teacher resource. It contains information relevant to the program. The teacher could use it for his/her information or could read selected parts to students from K-2. By Grade 3, students could read those parts applicable to Level 3 of the program.

Strengths
- very good resource
- easy to read
- clearly written so older children may read and understand
- glossary
- good, clear, colorful illustrations

Weaknesses
- paperback

Title: Burnett, J. Dale. Logo: An Introduction. Morris Plains: Creative Computing Press, 1982.

Annotation: This book has been recommended as a very good introduction to Logo for teachers. It is written for the MIT version of Logo for Apple computers but it can be adapted to fit other versions.

Strengths
- covers most procedures in an easy step-by-step progression from simple to complex
- activity oriented with ideas and opportunities to experiment

Weaknesses
- machine specific exercises (Apple)
- not enough introductory activities

Title: Computer Services. Taming TuRtleS is "TUR"-riffic. Winnipeg: Manitoba Department of Education, 1983. (MTBB)

Annotation: This manual is to accompany TRS-80 Model III/IV TuRtleS software. It includes hands-off activities, programming using the immediate mode and lessons for "taming" the turtle.

Strengths
- transparency masters for immediate mode activities
- answer key for activities
- Logo articles from various sources

Weaknesses
- not bound

Title: ----------. Training Your PET TURTLES. Winnipeg: Manitoba Department of Education, 1983. (MTBB)

Annotation: This manual was produced for use with the Commodore PET TURTLES software. It includes hands-off activities, programming using the immediate mode, and lessons on how to move the turtle.

Strengths
- transparency masters for immediate mode activities
- answer key for activities
- Logo activities from various sources

Weaknesses
- not bound

Title: Davis, Joan, and Joan Schwenker. Logo: Problem Solving for Primary. Spokane: Turtle Enterprise, 1983. (TUR)

Annotation: It is recommended as a good resource for teachers and students. The book is made up of 58 cards which are designed to be cut up and laminated to allow an individualized approach to learning Logo. The cards are designed to be used with an Apple microcomputer.

Strengths
- cards are numbered and become progressively more difficult
- produce interesting graphics
- good to place in a computer learning centre

Weaknesses
- more information needed to do some of the cards
- some directions too difficult for K-2 students to read independently

Title: D'Ignazio, Fred. The Computer Parade. Morris Plains: Creative Computing Press, 1983. (AL)

Annotation: This highly recommended fantasy story takes Katie and her brother Eric inside the computer to learn how sound is produced. It is best read aloud to students before they use it as reading material. Definitions and a flow chart of the story sequence are found on the fly leaves.

Strengths
- exciting, action packed, suspenseful story
- large, colorful pictures
- well bound hardcover

Weaknesses
- some concepts may be difficult to grasp

Title: ----------. Katie and the Computer. Morris Plains: Creative Computing Press, 1979.

Annotation: A highly recommended fantasy story about how a computer works. The teacher could read it aloud and explain the contents. Suitable as Grade 2 and 3 reading material.

Strengths
- story moves quickly to illustrate the speed of computers
- large, colorful, action-filled pictures
- element of suspense holds students attention
- introduces computer terms using a carefully chosen vocabulary
- well bound hardcover book
- students want it re-read many times

Weaknesses
- a lot of information introduced about how a computer works
- difficult for Grades K and 1 to follow

Title: Frank, Mark. The Prentice-Hall Concise Book of Computers. Scarborough: Prentice-Hall Canada, 1982. (PH)

Annotation: Recommended as a very good teacher resource book. It clearly explains the way a computer works and the applications of computers. A fairly high level of computer literacy makes the book more interesting. Some of the illustrations may be interesting for upper primary students.

Strengths
- at least one clear color picture or illustration per title
- one concept explained for each facing page
- up-to-date everyday examples and comparisons to explain computer concepts
- factual, comprehensive, informative
- high quality, hardcover book

Weaknesses
- terminology too advanced for students

Title: Girard, Suzanne, and Kathlene Willing. The Primary Computer Dictionary. Cobalt: Highway Book Shop, 1983. (HB)

Annotation: A very good introductory dictionary for primary students containing fifty of the most frequently encountered words in beginning computer literacy.

Strengths
- one definition per page
- bold titles, large print
- simple vocabulary used in definitions

Weakness
- paperback

Title: Papert, Seymour. Mindstorms: Children, Computers, and Powerful Ideas. New York: Basic Books, 1980. (FW)

Annotation: This book, written by the creator of Logo, is highly recommended as a teacher resource for an in-depth examination of the philosophy of Logo.

Strengths
- good explanation of the theoretical background of Logo
- good basis for individual application
- underlines the value of Logo and Logo-like languages

Weaknesses
- heavy reading

Title: Rice, Jean, and Sandy O'Connor. Computers Are Fun. Minneapolis: T.S. Denison, 1981. (MTBB)

Annotation: A book recommended as a student and teacher resource. Used in conjunction with the Teacher's Guide, it is a very good introduction to computers.

Strengths
- comprehensive
- good photographs
- written at a child's level

Weaknesses
- an American map
- material could be presented more attractively
- too "narrative" to use as a workbook

Title: ----------. Computers Are Fun: Teacher's Guide and Activity Book. Minneapolis: T. S. Denison, 1981. (MTBB)

Annotation: It is recommended that teachers use this guide in conjunction with the student book. The activities are suitable as an introduction to computer awareness. Contains a detailed outline for each chapter and activities for several grades.

Strengths
- contains reproducible blackline masters
- glossary, bibliography
- lists films, filmstrips and other multi-media (American listings)
- good activities for sequencing

Weaknesses
- most activities appear "dry"

Title: Ryder, Joanne. Star Wars: C-3PO's Book About Robots. New York: Random House, 1983. (RH)

Annotation: An excellent student resource about robots of today and tomorrow. Each facing page has a new title and colored illustration relating to the text. Covers many uses of robots.

Strengths
- simple, very easy to read for upper primary students
- good, clear, colorful illustrations

Weaknesses
- paperback

Title: Spencer, Donald D. Computer Awareness Book. Ormond Beach: Camelot, 1982. (CAM)

Annotation: This book is written for younger students. There is a large illustration and some text on each page. It is good for class discussions.

Strengths
- good, large illustrations
- vocabulary suitable for younger students
- large, clear type
- good for making overheads

Weaknesses
- some illustrations have a "busy" background

Title: ----------. Exploring the World of Computers. Ormond Beach: Camelot, 1982. (CAM)

Annotation: This publication is highly recommended as a teacher resource at the primary level.

Strengths
- easy to read
- well organized
- good illustrations
- explains the development of computers
- glossary

Weaknesses
- illustrations are all of one color

Title: ----------. Visual Masters for Teaching About Computers. Ormond Beach: Camelot, 1982. (CAM)

Annotation: This was recommended as a teacher resource because of the bold blackline drawings which could be made into transparencies. Teachers would have to select those illustrations appropriate to K-3.

Strengths
- large, clear drawings

Weaknesses
- limited application for K-3 Computer Awareness
- teachers could find other illustrations or make hand-down transparencies to get across the same message

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Title: Thornburg, David D. Every Kid's First Book of Robots and Computers. Greensboro: Compute Books, 1982. (HRW)

Annotation: As a basic introduction to Logo, this book is recommended for students and teachers. Young students can program using the "Big Trak" robot with adult guidance. Upper primary students can program the activities using the turtle titles (included in book) and/or a computer.

Strengths
- easily read and understood
- oversize print

Weaknesses
- must adapt the Logo vocabulary for different microcomputers
- some of the commands are confusing

Title: Watt, Daniel. Learning With Logo. New York: McGraw-Hill, 1983. (MH)

Annotation: An excellent Logo resource for teachers written using Terrapin/Krell Logo with appendices for Apple Logo and TI Logo.

Strengths
- simple instructions
- well sequenced activities ranging from simple to complex
- spiral bound book lays flat for use
- good diagrams and illustrations

Weaknesses
- the need to refer to appendices for other Logo versions

SUPPLIERS' CODES AND ADDRESSES

Thomas Allen & Son Ltd.
250 Steelcase Road, East
Markham, Ontario L3R 2S3 ..... AL

Camelot Publishing Co.
P. O. Box 1357
Ormond Beach, Florida 32074 ..... CAM

Fitzhenry & Whiteside
195 Allstate Parkway
Markham, Ontario L3R 4T8 ..... FW

Highway Book Shop
Cobalt, Ontario
P0J 1C0 ..... HB

Holt, Rinehart & Winston of Canada Ltd.
55 Horner Avenue
Toronto, Ontario M8Z 4X6 ..... HRW

Manitoba Text Book Bureau
277 Hutchings Street
Winnipeg, Manitoba R2X 2R4 ..... MTBB

McGraw-Hill Ryerson Ltd.
330 Progress Avenue
Scarborough, Ontario M1P 2Z5 ..... MH

Prentice-Hall Canada Inc.
1870 Birchmount Road
Scarborough, Ontario M1P 2J7 ..... PH

Random House of Canada Ltd.
1265 Aerowood Drive
Mississauga, Ontario L4W 1B9 ..... RH

Turtle Enterprise
N11515 Kathy Drive
Spokane, Washington 99218 ..... TUR